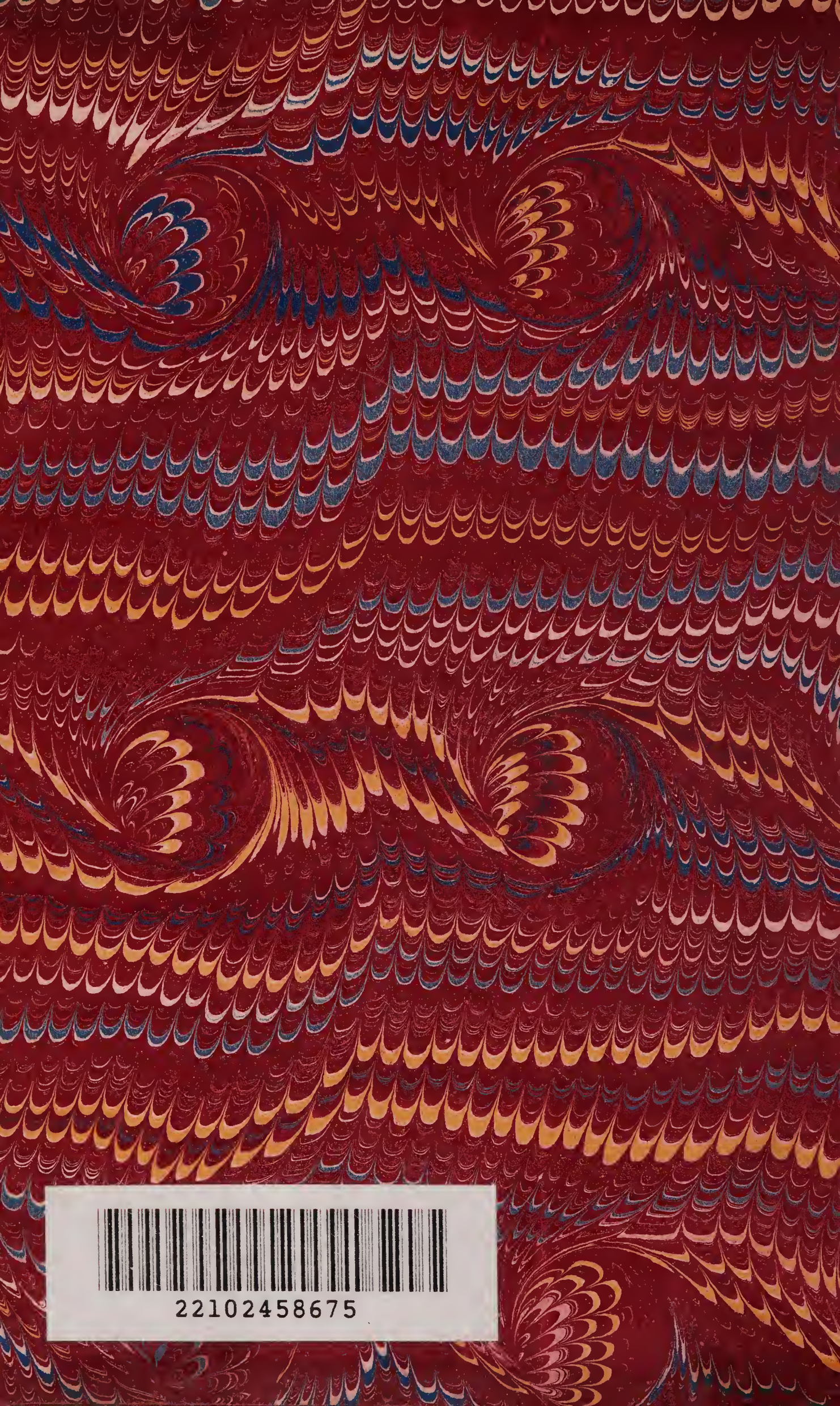
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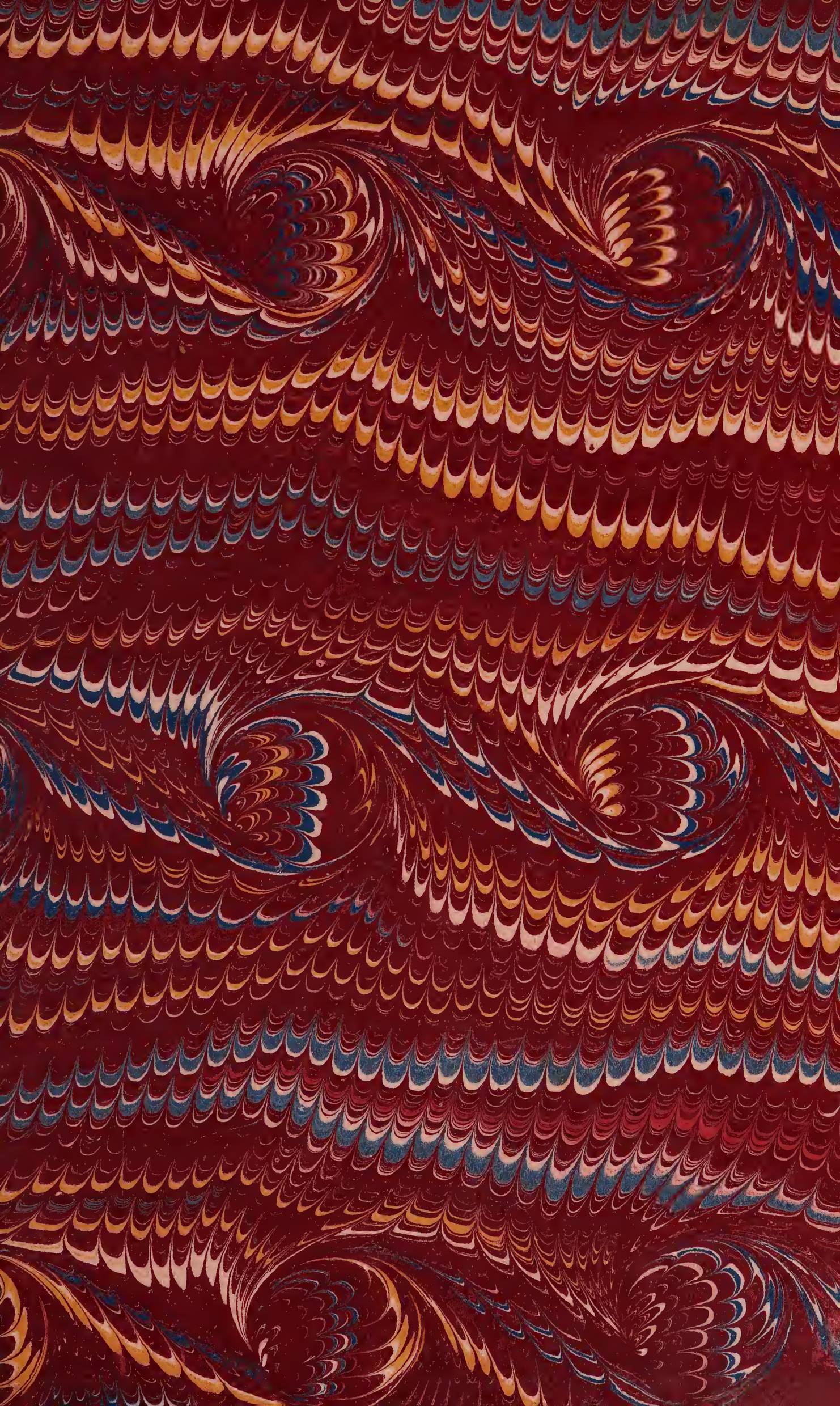

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THE MICROSCOPE.

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ORIGINAL COMMUNICATIONS.

CONSIDERATIONS IN TESTING OBJECTIVES.

EDW. BAUSCH.

THERE is a laudable desire in almost all persons possessing a microscope to become intimately acquainted with it, and for this purpose it is not only necessary to learn the use of its mechanical parts, which is simple, but to understand its optical capacity, which is considerably more difficult, and which involves more considerations than would appear on first thought.

With all the care which may be bestowed upon objectives, they are to a certain extent, works of chance, and depend upon the opticians judgment, industry and skill, and upon the variations in glass, for their excellence and uniformity. These conditions are often so varying that in the case of several objectives of the same formula, made at the same time there will be such great differences that it can hardly be perceived on the first examination, that they were to be of a kind. It is at this point especially necessary to detect the errors, to determine their cause and apply the remedy, and to do this properly often involves an inconceivable amount of work, and in many cases the final results are reached at a pecuniary loss. There are certain fixed tests for each kind of objective, and to the best of my knowledge all reputable opticians bring each objective up to its standard before allowing it to pass their hands, irrespective of the cost of doing so. This must of necessity be so, if only out of business consideration, and not for a love of such production, for it is evident that a well-earned reputation would soon lose its pre-eminence, and would acquire one for unreliable or poor work, if on comparison objectives of the same kind would show a marked difference. There is sometimes a fortun-

ate combination of circumstances which makes a certain objective better than its fellows, but this is a rare exception, and is positive evidence that the exact requirements of the formula have been complied with. As a rule, therefore, I believe that the opticians' claims may be relied upon, and where the results in the hands of the microscopist do not correspond with them, the cause may usually be looked for in the lack of experience in manipulation or in conditions, which differ from those under which the objective was completed. The belief, which I am aware is extant, that there are great differences in objectives purporting to be similar, is, in my opinion, not justified, at any rate in the productions of those men who, by general acknowledgement, are at the head of their profession. I admit that, as in everything which depends upon human skill, there is strictly speaking, no absolute uniformity, but also claim, that with few exceptions, the differences are so slight, that anything but the most expert manipulation cannot detect them.

It therefore appears to the writer that any information which will tend to improve the knowledge of testing objectives will not only prove beneficial to the microscopist, but will prove advantageous to the optician, in that his work will receive a fair trial, based upon a knowledge of the principles involved, and that he may be convinced that all his work which deserves commendation will be the better appreciated. The following points are by no means new, but are often lost sight of in making tests. The writer will speak of medium and high power objectives only, as the deleterious influences are most noticeable in these, but they apply as well to the lower powers though in a less degree.

The part of the instrument which has a strong bearing in the performance of the objective is the mirror. It should be adjustable on the mirror bar, so that it can be accommodated to the variations in distance of the source of light from the instrument. When parallel rays are used, as with light from the sun or clouds, its distance from the object should be decreased and increased when lamplight is used. It should be exacted that the focus of the concave mirror be within the limits of its adjustment. The serious disadvantage of its incorrectness in this respect can easily be seen by taking, for instance, a 1-5

objective which will resolve *P. angulatum* nicely with central light, when the mirror is exactly focused. By moving the latter out of focus it will be seen that the objective looses in performance, and if this is carried sufficiently far it will arrive at a point where the objective will cease to show any lines. The effect will be the same on any other object, and is caused by the lack of proper concentration of light on the slide. When oblique light is used, unless the diaphragm moves with the mirror, it should be removed, as the advantage of obliquity is diminished or destroyed by the loss of light.

The cover-glass exerts probably the greatest influence in testing as well as in general work. This should be used of a thickness which corresponds to that to which the objective (if non-adjustable) was originally corrected. If thicker or thinner covers be used, the objective will be spherically over or under corrected, and will have to be moved correspondingly above or below the plane (outline) of the object to distinguish its structure, if the variation is considerable the difference between the two planes will be so great that it will cease to show any structure, and it may then be said to be lacking in defining power although in reality it possesses it, but is not properly used. Generally speaking the objective may be said to be spherically corrected when it gives the best defined image; that is, when the outline and internal structure of an object of extreme thinness appears in one plane. When, after the objective has been focused on the outline of the object, it is necessary to increase the distance to focus on the structure, it is evidence that the objective is spherically over-corrected and that the cover is too thick; in an adjustable objective, the correction collar must be brought to its closing point, which means that the lenses are brought in closer contact. When the objective must be focused to a point beyond the outline of the object to see its structure; that is, brought closer to the cover-glass. it proves that this is too thin, and is then called spherical under-correction; to give the proper adjustment in an adjustable objective in this case the adjustment is opened—the lenses are separated. It requires a certain amount of study to distinguish these phenomena, and although it can be done in well prepared specimens, I know of none better than coarsely marked diatoms, such as *P. angulatum*.

Although I am aware that many eminent microscopists do not favor adjustable objectives for every day work, I must confess that I fail to see the force of their arguments. From the foregoing it will be seen that unless the cover-glasses are of a thickness corresponding to that which was originally used, the objective may be made to do imperfectly what is in its power to do well, and when pressed to its full capacity may and is likely to fail. It must be remembered that cover-glasses of the same number are not of the same thickness. The selection of those of proper thickness is expensive and tedious, whereas the knowledge of correcting the objective is easily acquired, and in the latter case it is in the manipulator's power to command the highest performance of which the objective is capable; further than this, it has the advantage that it may be used as a non-adjustable objective if desired. When homogeneous immersion objectives were first introduced they were mounted in fixed settings, as it was expected that the thickness of the cover-glass would not affect the correction; although this assumption was correct, it was found that even in these it was necessary. How much more then, is it required in dry or water immersion objectives?

Another factor in the disturbing influences is the variation in length of tube; the deleterious results are similar to those with varying cover-glasses. Objectives are usually adjusted to $8\frac{1}{2}$ or 9 inches length of tube, and although this in itself is a fixed standard, it usually becomes variable by changing objectives and eye-pieces. That it is so in objectives is patent, and that it is so in eye-pieces can easily be determined by making a change in powers, when it will be found that a change in focus is required. By decreasing the length of tube the objective will appear to be spherically under-corrected and *vice versa* when it is increased, so that it is apparent that by the use of the draw-tube the effect of the cover-glass may be partially neutralized; for instance when by the use of a thin cover, the objective is sperically under-corrected, it may to a certain extent be corrected by causing a corresponding over-correction in the tube by increasing its length. The use of the draw tube for the purpose of changing the amplification or for the matter of convenience, can therefore hardly be commended, except in cases where adjustable objectives are used.

Considerable also depends upon the perfection of the eye-piece. I believe that as a rule too little care is devoted to it; at any rate, it is certain that while any Huyghenian eye-piece for a telescope can be used on a microscope, very few which have been made for this can be used on a telescope, and while it is true that no such perfection may be required in the former it leaves such an indefinite range that it may become difficult to place a limit for the perfect and imperfect. In all work, and especially in testing, it should be seen that the eye-lens as well as field-lens are perfectly clean.

Among the absolutely necessary conditions in judging of the quality of an objective are perfect specimens, especially if they are sections. A thick object obstructs the light, and generally makes it necessary to go through so many layers or planes that it is difficult to get any one distinct; the impression may thus easily be given that the objective is at fault. The difference between two objects of the same nature may be so great, that while with one the objective may be condemned as imperfect, it may with the other appear of extraordinary excellence.

In conclusion, I will say that there may be other conditions which may influence the performance of a lens, and to acquire the power of eliminating them requires considerable experience. When an objective does not correspond with the claims of the optician, judgment should not be passed upon it until after repeated trials have been made, in all of which the above points should not be lost sight of.

THE WORKING SESSION.

ALBERT M'CALLA.

THE Executive Committee of the American Society of Microscopists have very wisely appointed Mr. C. M. Vorce, of Cleveland, Ohio, as committee in charge of the session for practical work at the next meeting of the Society, and it is to be hoped every one who can help will heartily co-operate in making that session a grand success. As the original proposer of the scheme I feel greatly interested in its growth. It was, from all accounts, a most interesting feature of the Rochester meeting, which I was unable to attend, and Mr. Griffith is en-

titled to great credit for making it so valuable and practically useful. No man knows better the special aptitudes of the widely scattered microscopical workers of our country than does "Uncle Ezra," and none is more filled with that enthusiasm which inspires enthusiasm than he. I note, however, that you have fallen somewhat into error in regard to his share in the Chicago meeting, where the "practical session" was first introduced. Whatever suggestions Mr. Griffith or others may have made in former years—about which I know nothing personally, except that they were only suggestions—I know that the idea of the need of a great increase in the practicality and "visibility" of our Microscopical Society meetings was one that early and independently suggested itself to me; and the plan of introducing a working session of one whole afternoon, with special hours each day for examination of slides, etc., referred to in the papers read that day, was resolved upon by me, almost immediately upon my election to the presidency of the Society, was outlined in my circulars and letters, and formally presented *in extenso* in a communication from me to the Executive Committee in March, 1883. After I had secured promises of co-operation from various parties, I wrote to B. W. Thomas, of Chicago, and to Mr. Griffith, to aid me in securing, by personal interview and correspondence, others of their acquaintance to assist in making this new departure a success. I did not, however, commit the whole matter into their hands, but actively organized and directed it up to the last moment, though very heartily and ably assisted, by Mr. Griffith especially, and by others. The scheme was regarded by me as the chief new departure of the Society that year. I hoped that my presidential year would be remembered and signalized by the inauguration of that new feature if by nothing else. I trust therefore I shall not be blamed if I courteously intimate that I am unwilling that Mr. Griffith or any one else should be made to appear as the author of a feature in our meetings which was originated and made an accomplished fact by myself. I have since heard, however, that a similar plan was proposed at the Microscopical Congress of 1878 by Mr. Griffith and others, to whom therefore I cheerfully yield priority of idea. Indeed I have no doubt that if I had not introduced the "practical ses-

sion" and its accompanying hours for study of slides and apparatus, some one else would soon have done so. The times were ripe for it, and all I believe are agreed that the interest and value of our meetings in the future will be greatly enhanced by a still greater prominence being given to this feature. Its importance can readily be seen. The papers, valuable as they may be, can be read at home and understood fully as well as by those who journey to the meetings, and if one cannot share in the discussions, he can follow them more clearly often from the printed report than from the hearing of the ear. The cost of a trip to one of the meetings will buy a dozen treatises and periodicals full of papers, and if that is all which may be learned at the American Society of Microscopists, they may be wisest who stay at home. But if an opportunity is given for careful study of specimens described in the papers, and of apparatus exhibited, and if the various processes and methods of work are practically shown by experienced manipulators, then our meeting will afford to those who attend something which cannot be learned from books or journals or any mere verbal descriptions, and those who journey to them will be well repaid. But other reasons I must defer to another time.

A LITTLE INFUSORIAL TERATOLOGY.

BY ALFRED C. STOKES, M. D.

THE struggle for existence is as great among the invisible inhabitants of the standing pool as among the animal life of the forest, the plants of the field, or the largest denizens of the aquatic world. Among the lowly infusoria the stronger prey upon the weak quite as often as the multicellular and macroscopic creatures about us destroy their less powerful neighbors. Not an evening passes without bringing to the gaze of the microscopical observer some portion of the struggle. An infusorian captures a monad, a rotifer seizes the animalcule, the rhizopodous Actinosphærium engulfs the rotifer, a Turbellarian worm swallows the rhizopod, a fish takes the worm, and finally an Izaak Walton hooks the fish. Those slightly stronger than the weakest sometimes escape immediate slaughter, only to present the results of the contest to the end of their little life.

It is a few of the latter that I want just now to show the reader.

The infusorian which the writer has elsewhere named *Loxodes vorax*, has an elongated flattened body, with the anterior and posterior borders evenly rounded, as in Fig. 1, the former part curving somewhat toward the left-hand above the adoral groove and the chitinous, sickle-shaped pharyngeal tube. It is very soft and flexible, often doubling on itself so that the cilia of one-half of the ventral surface, to which they are confined, wriggle against the cover-glass, while the remainder are paddling on the slide. It is perhaps on account of this soft structure that it is so peculiarly liable to maiming and deforming accidents. I have taken it in shallow ponds, at the bottom of which it delights to grovel, with so much of its substance removed from unexpected spots and in such unexpected patterns, that if the whimsical form thus presented could become permanent and be transmitted to its descendants, they would rank among nondescript curiosities like Barnum's mermaid or woolly horse. In Fig. 2 is shown an example, with a triangular piece

Fig. 1.

Fig. 2.

Fig. 3.

gone from the right-hand lateral margin, and a linear projection resembling a thickened cilium, conspicuous on the left-hand dorso-lateral border. It is not easy to imagine how or by what a piece of that shape could be taken from the sarcode. The animalcule was under continuous observation for several hours, but the wound, if it was a wound, did not close. The creature became more and more sluggish, and at last turning over to the malformed side, it quietly died; the body speedily disintegrated, the double nucleus faded away, and nothing was left of the Loxodes but a few amorphous particles trembling in the

field. In another instance the anterior end was split into two parts for one-third the length of the adoral groove, so that the animal appeared to be doubly proboscidate, each trunk being independently movable and not at all a perceptible inconvenience. This was not, as at first supposed, the beginning of reproductive division, as that process was subsequently observed to take place by the comparatively rare oblique transverse fission. Another individual had lost a segment like a wedge of pie, from the posterior tip of the body, and was seemingly as lively and voracious as ever. Some evenings later two specimens of Loxodes were captured malformed as shown in Fig. 3, where the whole frontal border had disappeared for one-half the length of the pharyngeal tube, which projected for that distance beyond what was then the anterior margin. They were apparently as active as normal specimens.

Ileonema dispar (Fig. 4), which the writer described with the precedings in the "*American Journal of Science*," is also a lover of the debris at the bottom of the pool, and is subject to an accident whose cause is usually visible. The remarkable trailing, non-vibratile flagellum at the anterior extremity is formed of a thick, cord-like basal portion, and a distal filiform prolongation. The extreme tip of the latter part seems to have great affinity for glass. It scarcely ever touches the slide without adhering so firmly that the owner is at once a prisoner. Escape is made without delay, but at the expense of the thread-like part of the flagellum,

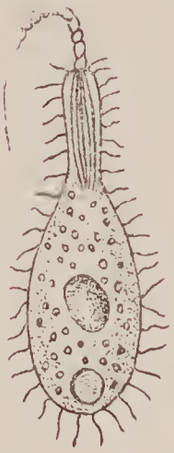


Fig. 4.

the infusorian in pulling loose even occasionally leaving a portion of the cord-like base, the wound soon healing by the formation of a bulbous enlargement.

Some time ago considerable interest was manifested when Mr. M. H. Robson, in "*Science Gossip*" for October, 1879, announced his discovery of *Euglena viridis* with a bulbed flagellum, and numerous explanatory theories were offered. A bulbous extremity to a normally filiform flagellum is by no means rare. I have witnessed it in many genera, and the observations lead me to conclude that the condition is a sign of injury, a symptom of disease, or of discomfort induced by uncongenial

surroundings, or perhaps, as suggested by Saville Kent, "a phase preliminary to its entire withdrawal, and antecedent to the entrance of the animalcule upon the encysted or resting state." *Trachelomonas volvocina*, Ehr., is not known to become encysted, propagating itself by subdivision into monadiform germs; yet I have seen it with a bulbous flagellum.

But the accident to Ileonema is a trivial one so far as any apparent discomfort is concerned, and indeed the entire flagellum is sometimes lost by adhesion and rupture after the distal portion is gone. This separation of either part occasionally follows contact with a mass of dirt or bit of alga; so the glass is not always the sole cause.

The loricated collar-monads, whose symmetrical forms "snatch a grace beyond the reach of art," are not exempt from the "darts and slings of an outrageous fortune" that batters their sheaths, and worsts them in the fray. These minute creatures, whose homes are crystalline Portland vases, Egyptian tear-bottles, and transparent amphoræ from whose delicate lips Queen Mab herself might feel it a privilege to drink, even these comely atomies do not always succeed in perfecting their protective coverings. In Fig. 5 is shown the perfect lorica and enclosed zooid of *Salpingœca fusiformis*, S. K., an abundant spe-

Fig. 5. Fig. 6. Fig. 7. Fig, 8. Fig. 9. Fig. 10.

cies; while in Figs. 6 and 7 are delineated the empty loricæ of the same species malformed to a remarkable extent. The former (Fig. 6) was observed on a leaflet of Myriophyllum, and was then alive and well in its misshapen home; the latter (Fig. 7) was attached to a diatom, and both were dead and empty when found. By what freak or by what unknown exigency the characteristic contour was abandoned and these unsymmetrical, hunch-backed loricæ secreted, it is difficult to conjecture. And not much easier is it to guess how the zooids within the

sheaths shown in Figs. 8 and 9 happened to select such whimsical patterns, when the typical form that should have been produced is exhibited in Fig. 10, which is the empty loricæ of *Salpingœca Steinii*, S. K. The species forms characteristic rosette-like clusters on algal filaments or fine leaflets, and it was within such a cluster that these two malformations were observed. It may readily be imagined that the lorica of Fig. 8 shows the impress of an impinging fibre, a thread of alga, or other delicate filament, around which the plastic, growing lorica was forced, and that the one shown in Fig. 9 grew up between four parallel and superposed vegetable fibrils, which left the indelible mark of their roundness in the soft structure. But these are guesses only. Nothing more explanatory than a guess was to be found in the vicinage.

Although so plentiful that they often encrust the supporting object until the surface is completely obscured, the members of the Choano-Flagellata, the collar monads, possess a charm that never palls, a grace that is always elegant, and a shapeliness always bonnie. They are beautiful even in deformity.

Trenton, N. J.

CYCLOSIS.

A MICROSCOPIC LYRIC.

We were watching for cyclosis
In a Tradescantia-cell,
Where the protoplasmic wave seemed loth to flow;
Though we sought by endosmosis
The clear sap therein to swell,
And to start the denser fluid to and fro.

We but moved the mirror slightly,
The adjusting-screw a thread,
The reticulating lines were plainly seen;
In the nucleus shone brightly,
Granules white and granules red,
With the lesser granules bobbing up between.

What was that? A little quiver
Seemed along the edge to stray—

All the granules were on tremble there below!
Then a current like a river,
Taking pebbles in its way,
Could be traced along the center in its flow.

When did it commence? we queried,
Was the fluid there the same,
Flowing from the nucleus outward to return?
While we gazed till eyes were wearied,
Changing focus, mirror, flame,
Seeing all and yet unable to discern?

In the more ethereal presence,
Where the deep emotions dwell,
There may be an outward current ere we know;
And some moment of quiescence
May reveal its tidal swell,
Like the ripple of the protoplasmic flow.

MARY H. WHEELER.

Pittsfield, N. H.

RESULTS OF MICROSCOPICAL RESEARCH.

MOUNTS OF FRESH-WATER ALGÆ.—A writer, under the initials of W. A. W., relates his experience in the *Microscopical News* (iv, 216, 1884) in attempting to make permanent mounts of fresh-water algæ. He comes to the conclusion that the best medium is water to which a slight amount of camphor water has been added to prevent the growth of fungoid and algoid organisms. One of the difficulties usually experienced is in the fading of the chlorophyll, and this W. A. W. would try to prevent by boiling the water so as to expel the air and using it before it has had a chance to absorb more oxygen from the atmosphere. The influence of light is also injurious and hence the slide should be kept in a dark place.

DEVELOPMENT OF FISHES.—Mr. Geo. Brook, Jr., has been studying the development of *Motella* and finds that there is an embryonic cranial flexure and a ventral mouth analagous with those so characteristic of the sharks and skates.

STRUCTURE OF HALIOTIS.—*Haliotis* is commonly known as the ear shell; in California it is called abalone. The shell is iridescent red or green and is used extensively in inlaying papier mache. One of the peculiarities of the shell is a series of openings which follow the course of the spiral. The structure of the animal itself presents many interesting features which have recently been commented upon by H. Wegmann (C. R. 1884, p. 1385). These all go to show that in many points the ear shell is similar to the acephalous molluscs like the clam and the oyster. Thus the renal organs are paired, the heart is provided with two auricles and two well developed gills and two rudimentary ones are present. The intestine is ciliated internally; the genital system is remarkably simple and lacks the accessory organs so common in the gasteropods. On the question of paired organs in some gasteropods and their obsolescence in others, the reader will find many important hints in the article "Mollusca" in the Encyclopedia Brittannica, from the pen of Prof. E. Ray Lankester.

A POINT FOR INVESTIGATION.—Some recent researches made by an English chemist, but not yet published, show that the bright blue color of the blood of *Limulus* and of scorpions is due to the presence of copper. This suggests another microchemical research which might be profitably followed. The curious marine worm *Balanoglossus* gives off a strong odor of bromine. It would be interesting to ascertain whether this element is present in these worms in larger quantities than in ordinary sea-water.

A GROUP TO BE STUDIED.—One sadly neglected but interesting group of insects is represented everywhere and especially commends itself to microscopists. This is the group known as Thysanura, or in popular terms "bristle-tails" and "spring-tails." On turning over some board which has been lying for some time on the ground, one will almost invariably find numbers of minute insects which jump to a considerable distance by means of a forked spring beneath the body. Others of the group may be found in cellars, under decaying leaves or on growing bushes. To collect them from a board all that is necessary is to hold a small vial so that they will jump into it. If the inside of the vial be moistened with alcohol they will not be able to jump out again. In collecting in the woods the dead leaves

should be picked up and shaken over a bit of white cloth; then upon picking up the larger pieces the minute insects can be readily seen. Forms on living plants may be obtained by beating, a process familiar to all insect collectors. The specimens should be kept in alcohol, or, if desired, they can be mounted on slides. One of these insects is familiar to microscopists under the generic name *Podura*, its scales being a favorite microscopical test object; but others of the group are far more handsome than this one, and from the fact that they are the lowest of six-footed insects a careful study of them will give one a good idea of the essential points of insect anatomy. Our American species have scarcely been touched, the only paper of any importance being that by Dr. A. S. Packard noticed below. It will well repay any one to study these forms and in doing this he should have the more prominent works relating to them. Of these the most important is Sir John Lubbock's Monograph of the Collembola and Thysanura, published by the Ray Society and illustrated with nearly eighty plates. Next in order comes Dr. Packard's Synopsis of the Thysanura of Essex county, Mass., published in the fifth annual report of the Peabody Academy of Science (1872). The student, however, should not neglect the literature of the European forms, for many species are common to both continents, and hence the writings of Tullberg, Meinert, Brook and Nicollet should be consulted. Brook's papers have appeared in the Journal of the Linnean Society of London, while those of Meinert are published in Denmark, and those of Tullburg in Sweden. In this connection should also be noticed those forms which are now associated here and which form the genus *Scolopendrella*. In shape they are much like a centipede but their size is much less; in reality they have but little affinity to the centipedes. Our forms have been described and figured by Ryder in the Proceedings of the Philadelphia Academy of Natural Sciences, and by Packard in the American Naturalist. Researches in the anatomy and development of any of these forms carried on by means of sections would prove very interesting and very important.

DEVELOPMENT OF THE LEECH (CLEPSINE).—Several persons have studied the development of the various species of leeches, the most valuable paper being that by Whitman (Q. J. M. S.

1878), while years ago Prof. Abram Sager described a few facts in the Peninsular Journal of Medicine and allied Sciences. Some of Whitman's results have been challenged and recently Joseph Nussbaum (Z. A. No. 181, p. 609, Nov. 17, 1884), continues the dispute. Whitman describes four pairs of large cells in the developing leech which he calls neuroblasts, supposing that they form the nervous system. Nussbaum says that these so-called neuroblasts in reality give rise to what Whitman has called segment cells although he failed to see the connection between the two. As described by Whitman these segment cells give rise to the reproductive organs. The nervous system arises in the way now known to be all but universal in the animal kingdom—by a differentiation from the epiblast. It soon becomes separated from its parent layer and enveloped in a neurilemma of entodermal origin. The three blood sinuses arise as differentations of the body cavity which is divided into three parts by longitudinal partitions each side of the nervous cord. A curious dorsal organ which disappears with development is also described, the purpose of which seems to be to fasten the embryos together.

THE STUDY OF PARASITES.—Professor Herbert Osborn of Ames, Iowa, is engaged in the study of the lice found on birds and mammals and would like specimens from all parts of the country and from every species of animal. These lice are far more common than is usually supposed. Almost every species of bird or mammal has its peculiar parasites which may be found by looking among the fur or feathers. In birds their favorite place is on the head or neck, for the host is unable to reach these parts with the bill. Specimens may be sent in alcohol or mounted on slides but each lot shold be labelled with the name of the animal from which they were taken. Under the microscope they are very interesting and beautiful and far from the loathsome animals that lice are usually supposed to be.

OUTLINES OF EMBRYOLOGY.

I. INTRODUCTION.

THERE exist to-day but few more profitable fields for investigation than that presented in the embryology of insects; and since these forms are accessible in all parts of the country,

one does not have to make those pilgrimages to the sea-shore that are necessary to study the development of so many types of animal life. So, with the view of interesting inland students in this department of study by placing before them a short abstract of what is at present known and the points upon which information is desired, together with suggestions upon the methods of study, the present series is prepared for THE MICROSCOPE.

In order to make the account intelligible, we must preface it by a general account of the early stages of development of all of the higher groups of the animal kingdom, taking up first the typical processes and then the variations, showing at the same time their similarities and the causes of the differences observed in nature. After this the peculiar modifications found in the insects will be more easily understood.

Naturalists have divided the animal kingdom into two great groups, the Protozoa and the Metazoa. In the former the animal consists of but a single cell, in the latter of an aggregation of cells, variously combined. Each protozoon possesses in itself all the vital functions of the higher animals, though of course in a very low condition. Thus the one cell of these animals possesses the powers of sensation, motion, digestion, circulation, excretion, reproduction, etc. In the Metozoa we find a differentiation of functions. Accordingly as the animal is simple or complex, this specialization is carried farther and farther. Instead of each cell having all the functions of the single cell of the protozoon, the cells are united into tissues, one of which, for instance, has sensory, another digestive, and a third motor functions. Now in all the Metazoa these various tissues have all arisen from a single cell, morphologically equivalent to the single cell of the Protozoa, and this process of the differentiation of functions and of tissues is that studied by embryologists. The differences between a complex animal like man and a single celled animal seem immense, but the various steps can be traced with unerring accuracy, and it is found that the transitions are not sudden, but gradual.

The reproduction of a protozoon is always accomplished by division. At certain periods one of these complete animals will divide, and the result is two or more individuals like the first.*

* Reproduction by encystment is but a modified form of the more common reproduction by division, and does not need mention here.

Apparently closely connected with this fission is a process known as conjugation, though the physiology of the act is rather obscure. Two individuals will come together and unite, at times being completely fused together. Then they separate. The probable interpretation of this act will be apparent further on. The result of the fission in the great majority of Protozoa is to form two new individuals, but in some the resulting cells remain attached to each other, and a compound animal is the result.

In all other animals reproduction by eggs is the rule, although in the sponges, cœlenterates, worms, etc., a true fission occurs. What is an egg? Most people have a general idea on this subject, but since their opinions are founded upon that most familiar object, the egg of the common hen, their ideas are rather confused. The egg of the common fowl contains all the essential elements of the typical egg, plus a good deal more. Let us for a moment consider how an egg is formed. In all the Metazoa certain tissues have reproductive functions, and from them arises, in the female the egg, in the male the spermatozoan. These genital tissues are made up of cells; at an early stage the cells are all alike, but with growth and approach to maturity certain of these cells become greatly larger than their associates, and these are destined to become eggs. By the aid of a microscope we can distinguish no important differences between these eggs and the surrounding cells, but there is a vast difference physiologically. Each of these eggs when fertilized and placed under the proper conditions possesses the power to reproduce the being from which it arose.

In structure the only parts which are common to all eggs are those which at the same time are common to all cells. It is a mass of naked protoplasm, with a nucleus, and in this a nucleolus. To these various other portions may be added. Thus the yolk may be enveloped in a delicate membrane (vitelline membrane) formed by the protoplasm of the egg, or by a chorion, usually a much thicker membrane, secreted by the follicle cells in which the egg arose. Secondary envelopes like the shell of the eggs of birds and reptiles may also be present, but as will readily be seen they are not all important, being merely protective, and taking no part in the development.

Another adventitious element which is frequently present,

and which exercises important influences over the early stages of the egg, is "food-yolk" or deutoplasm, as it is usually termed. The function of this is to supply nutriment to the growing embryo, and by the vital forces of the egg it is gradually transformed into protoplasm as it is needed. The protoplasm of the egg is clear, homogeneous and transparent, but the deutoplasm is usually broken up into granules, so that it is nearly or quite opaque. This is not always the case, for in many pelagic fish-eggs the food-yolk is as clear and transparent as the protoplasm. The food-yolk is very variously distributed. In some it may occur in equal amounts in all parts of the egg, or it may be concentrated at the centre, or at one of the poles, or intermediate conditions may exist; and each varying arrangement is the cause of great differences in the development of the egg. The protoplasm is the active, the deutoplasm the passive element.

a. Maturition.

After the egg is fully grown there remains one last step in the ripening process, which is known as the maturition of the ovum. Some of the points of this ripening have long been known, but their significance was first pointed out by Minot and Balfour some five years ago, almost simultaneously. To study these phenomena at all carefully one needs a small and nearly transparent egg, for the successive stages can best be studied in the living ovum, and for this reason the most detailed accounts we have relate to the eggs of the star-fishes and sea-urchins. At the time that the egg leaves the ovary it possesses the essential parts enumerated above, but shortly begins to undergo some of the most wonderful changes. In the case of the star-fish eggs they begin as the egg enters the salt water. These changes are most apparent in the nucleus. First the wall of the nucleus breaks down and the clear protoplasm contained in it takes an irregular outline, the nucleolus

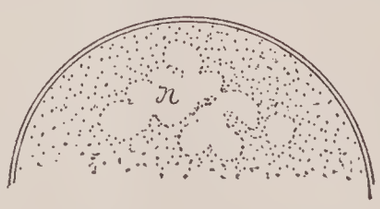


Fig. 1.—Portion of egg with the nucleus and nucleolus broken down; *n*, the last remnants.

still persisting. In a short time the process is carried further, and the result is as shown in Fig. 1. At last the nucleus disappears.

The next step is the formation of what is known as an amphiaster, a peculiar arrangement which always precedes cell-division. The granules of protoplasm and deutoplasm become arranged in the shape of a spindle, and in sections look almost exactly like the peculiar figures seen when iron filings are exposed to the influence of a powerful magnet. Between the two poles they form lines like the meridians on a map, while in other directions they radiate from the poles, giving the extremities a star-like appearance. One end of this amphiaster is near the surface of the egg, the other is at some distance below it. Soon from the outer end of the spindle a slight protrusion is seen, and a portion of the egg is extruded; this is the first polar

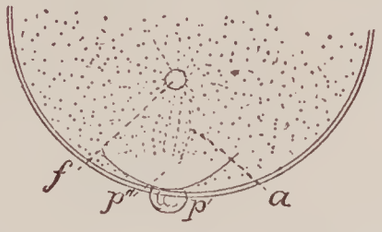


Fig. 2.—Formation of polar globules; *a*, amphiaster; *f*, female pronucleus; *p'*, first polar globule; p'', second polar globule.

globule. Soon the process is repeated and a second polar globule is formed, and occasionally still more. The remainder of the amphiaster now sinks to near the centre of the egg, and forms what is known as the female pronucleus.

Before considering the meaning of this phenomenon, let us turn for a moment to the formation of the male reproductive elements, known as the spermatozoa. In the male reproductive organs are certain cells, originally not distinguishable from those which produced the eggs. These cells give rise to the spermatozoa, several or many of which are formed from a single cell. When ripe the cell breaks down and the spermatozoa escape, but it is especially to be noticed that so far as we know the whole of the cell does not become converted into reproductive elements, but that a certain portion remains behind.

Now, what is the explanation of these facts? It is not certainly known, but the following hypothesis, put forth almost simultaneously by Balfour and Minot, has considerable plausi-

bility. It starts with the supposition that each cell is originally neither male nor female, but rather that it contains both elements. The process is diagrammatically shown in the adjacent cut, adapted from Minot. *a* represents a germinal cell contain-

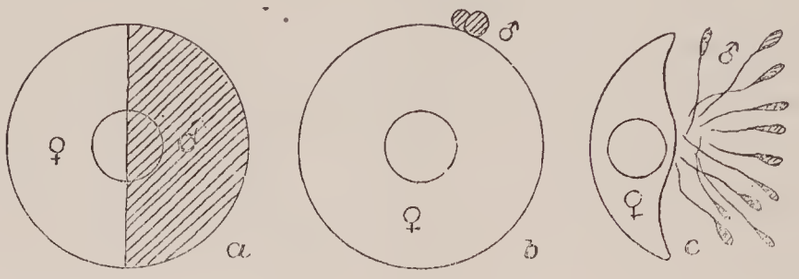


Fig. 3.—Diagram of modifications of an originally simple cell, *a*; *b*, elimination of male element (polar globules) to form the egg; *b*, production of spermatozoa, the female portion of the cell being left behind.

ing both sexual elements. In the egg (*b*) the pronucleus, or male element, has escaped, and the egg is now exclusively female. In *c* the spermatozoa are escaping from the germinal cell, leaving the female portion behind. *b*, as will readily be seen, represents the egg with the female pronucleus found.

From this it would seem that the egg in order to be fertilized needs to get rid of the male element, which originally belonged to it, and that a new male element was necessary. There is one series of facts which has its bearing upon this hypothesis, which may be mentioned here. In almost every group of the animal kingdom the formation of polar globules has been witnessed except among the arthropods and rotifers, where the evidence in favor of their production is as yet very slight. Here is a point for investigation. Are polar globules formed in either of these groups? Now it is a peculiarity of these two groups that here alone does parthenogenesis occur. Eggs of both insects and rotifers have again and again been known to develop without the presence of the male element or spermatozoa. It is therefore at least plausible to suppose that that portion which is expelled in other groups, by being retained here is sufficient to cause the egg to develop. Whether subsequent researches will confirm this idea cannot be foretold, but the speculation is at least an interesting one.

VIEWS ON THE CHOLERA BACILLUS.

J. M. Adams, of Watertown, N. Y., has a slide of genuine cholera bacilli from Egypt.

In 1831, M. de Lessep was in the midst of the cholera in Egypt. He turned his house, in which he continued to live, into a hospital; yet the plague never touched him. He deliberately asserts that he never knew a FEARLESS man to die of cholera.

The word "microbe," now so commonly used, was coined by M. Charles Sedillot, of Strasbourg, in February, 1878, in a paper which he read on the application of M. Pasteur's discoveries to surgery. Coming from the Greek words μικρος, small, and βιος, life, it aptly describes the thing intended. In replying to M. Sedillot, M. Pasteur used the word twice, and scientific men have since generally adopted it.

A GENERAL DENIAL.—T. R. Lewis denies the validity of Dr. Koch's conclusions as to the "comma-shaped" bacillus being the cause of cholera, as bacilli identical in size, form, and in their reaction with anilin dyes with those found in choleraic dejecta are ordinarily present in the mouth of perfectly healthy persons.—*Nature.*

THE BLOOD IN CHOLERA.—The cholera commission appointed to examine the epidemic have submitted a report. They state that they followed the course of the disease by hourly examining the blood of persons stricken. They found that in each case at first a few of the globules presented an unhealthy appearance, then a third were effected, than a half, then two-thirds, finally death resulted. The important fact is developed that all the globules are not simultaneously affected.—*Ex.*

A LACK OF FAITH.—Dr. Klein, who with Dr. Gibbes, assisted by M. Lingard, forms the English committee sent to India to study cholera, to show his want of faith in the cholera bacillus, deliberately swallowed a number of them.—*Ex.*

SCIENTIFIC ABERRATION.—Dr. Klein, of London, to show his disregard for and lack of faith in Koch's comma-bacillus, has made a meal of them recently. It is really strange that men of high scientific standing should indulge in such puerile business. The *Berliner Klinische Wochenschrift* says: "We had looked

for something better from Dr. Klein and must confess that this so-called auto-experiment gives us no great idea of the discernment and powers of criticism of the above named gentleman."

And the *British Medical Journal*, fully appreciating how ridiculous the affair is, states that everybody in London laughs at the experiments.

Such experiments prove little or nothing. If the experimentalist suffers nothing it is more reasonable to suppose that the infective matter did not find a proper soil for development; that the material taken does not possess specific qualities is not to be directly inferred.—*Ex.*

A CRITICISM FROM INDIA ON THE CHOLERA BACILLUS.—The *In. Med. Gazette*, in the course of an elaborate review of Koch's work and discovery, says: "A review of the whole evidence brought forward by the German Cholera Commission shows that they have only succeeded in establishing the fact that a peculiar form of bacillus is normal to the intestines of cholera patients; but the exact part which this organism plays in the morbid process is left wholly undetermined. Only a very moderate degree of probability has been made out in favor of this bacillus being the cause of cholera; but the futility of trusting to probabilities and conjecture in an etiological inquiry into cholera is generally well recognized. The problem, therefore, of the causation of cholera still remaining unsolved, it awaits and ought to receive that careful attention which its great importance demands." It is not fair to depreciate the value of Koch's discovery; but, on the other hand, it will do no good to give to it any greater weight than the evidence strictly justifies.—*Medical Record.*

EDITORIAL NOTES.

WILL subscribers wishing our journal for 1885 please renew at once?

THE issue of this number of our journal reaches two thousand copies.

THE connection heretofore existing between Dr. H. H. Chase and H. R. Spencer & Co., has been dissolved by mutual con-

sent, and hereafter the business will be carried on in the name of the old firm.

WE are not in the habit of sending sample copies to non-subscribers. The proper thing, therefore, for a non subscriber to do, upon seeing a copy of the journal, is to send his dollar and try the journal for a year.

AS beautiful slides as we have ever seen are prepared and sold by Mr. W. C. Walker, of Utica, N. Y. Many of our readers are familiar with his unique way of finishing a mount. The preparations consist of ordinary and test diatoms.

BAUSCH & LOMB announce that they are now making a series of new microtomes ranging in price from $22 to $50. The knife is carried on a sliding block, as recommended by Professor Thoma, and the microtome has many improvements.

A LARGE amount of interesting and practical matter on methods of work and mounting, is held over for our next issue. No microscopical journal published in the whole world contains such a proportion of "original coummunications" as THE MICROSCOPE.

DR. ALLEN Y. MOORE, of Cleveland, wrote us some weeks ago that a promised article still remained unfinished, "on account of a very difficult case *in court.*" The *case* has proved to be Miss Gertie Neele, of Coldwater, Mich., to whom the doctor was recently married. We hope this case will always remain *in court.*

OUR readers will pardon us, we are sure, for calling attention to the fact that the junior editor has just been elected a Fellow of the Royal Microscopical Society of London. Mrs. Stowell is the first American lady thus honored, and the third lady ever elected to membership, the two ladies thus previously honored being residents of London.

AMERICAN microscopists have never had such a feast of good things laid before them as THE MICROSCOPE offers for 1885. The articles on "Embryology" will appear in each number through the year, as will also those on "Results of Microscopical Research." Arrangements are well under way for a complete series of illustrated articles on "The Identification of Diatoms." The "Studies in Histology" will be continued from last year,

and continued articles have been promised on Photo-micrography.

WHILE we are pained to record the death of such an earnest worker as Dr. John Frey, of New York, yet to the older lovers of microscopical science will the announcement bring especial sadness. For over forty years Dr. Frey was actively engaged in the study of those things revealed by the microscope. At the time of his death, which occurred on the 4th of December last, he was Vice-President of the Microscopical Society of New York City, and General Superintendent of the dispensing department of Bellevue Hospital.

TENNYSON CALENDAR.

L. Prang & Co., of Boston, give a very handsome calendar for one dollar. Each day we have before us some new quotation from this favorite author.

ODONTOLOGY. By Prof. C. L. Ford, M. D., D. D. S., LL. D., Professor of Anatomy and Physiology, Univ. of Mich.

Professor Ford presents in these fifty pages a vast amount of knowledge on the development and structure of teeth, human and comparative. The work is arranged mostly in the form of questions, and thus becomes a valuable addition to this author's well-known series of "Questions." Any student, with this book for an aid, with access to the large illustrative collections of Prof. Ford, and with his oral instructions, who fails in Odontology, is surely *non compos mentis*.

Among our most liberal advertisers is the firm of Reed & Carnrick. The attention of our medical friends is called to their advertisement of cod-liver oil and milk. The oil has been artificially prepared for assimilation with pancreatine, and even the milk has been thoroughly digested as well. It is a great advance upon previous productions for similar purposes, and we believe it to be greatly superior to any preparation of cod-liver oil now in the market. They have, as they deserve, the unanimous support of the medical profession.

THE MICROSCOPE.

VOL. V. ANN ARBOR, FEBRUARY, 1885. No. 2.

ORIGINAL COMMUNICATIONS.

OUTLINES OF EMBRYOLOGY.

SECOND PAPER.

b. Impregnation.

THE maturation of the ovum and the formation of the polar globules may take place either before or after the impregnation, though in logical sequence it is really first in order. In the light of the previous section we see that impregnation is really the replacement of that which was lost, and in such a way as usually to ensure cross-fertilization, which has been shown to be highly beneficial to the race. We need but to allude to the investigations of Darwin and Hermann Müller in this connection, and although their labors were almost entirely confined to the vegetable world, the same circumstances and necessities exist here.

In discussing the phenomena connected with impregnation we have again to return to the investigations of Hermann Fol on the echinoderms as a basis for our studies. Dr. Fol has a peculiar compressor which he uses in his investigations, which is admirably adapted for its purposes. Without attempting to describe it now, we may mention its advantages and the methods of using it. The eggs of the star-fish were taken from the parent and placed with sea-water between the two glasses of the compressor, which were brought together as closely as possible without injury to the eggs. Some of the milt was then taken from a male star and placed in the compressor through a hole in the upper glass, the eye being at the same time applied to the microscope.

Very soon the spermatozoa were seen to enter the field and approach the egg. Around the egg is a thick layer of mucus,

but as yet no vitelline membrane. The spermatozoa become entangled in this mucus, and hence travel much more slowly here than in the sea-water. Almost immediately the protoplasm sends out a long and slender process to meet the nearest spermatozoon; or if there be two or more equally near, a corresponding number of protoplasmic prolongations are found, as shown in Fig. 4. Soon the process and the spermatozoon meet,

Fig. 4.—An egg sending out a protoplasmic filament to meet a spermatozoon.

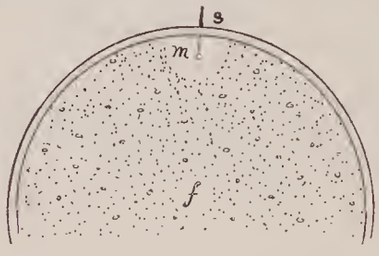


Fig. 5.—Entrance of a spermatozoon into an egg. *f*, Female pronucleus. *m*, Male pronucleus. *s*, Remnant of spermatozoon.

and then the former begins to retreat to the surface of the egg, drawing the latter with it (Fig. 5.) Now the egg secretes the vitelline membrane, and no attention is paid to other spermatozoa. Gradually the spermatozoon sinks into the egg, and as its head penetrates the yolk there begins the formation of a clear space like the female pronucleus, which from its origin is known as the *male pronucleus*.

These two pronuclei now approach each other, and finally unite to form the *nucleus of segmentation*. In most cases but a single spermatozoon is needed to fertilize an egg; indeed, as we shall see further on, the entrance of more than one of these organisms being in some cases decidedly disadvantageous. In other cases several are required to perfect the operation.

In eggs with a hard chorion there is frequently an opening known as the *micropyle*, by which the spermatozoon obtains entrance to the egg proper; in others there is nothing of the kind. In our friends, the insects, one end of the egg usually bears a peculiar and complicated apparatus known as the micropylar cap, which will be described in somewhat of detail when treating of the development of those forms.

c. Segmentation.

After the union of the male and female pronuclei to form

the nucleus of segmentation, as described in the preceding section, this compound structure occupies a place more or less removed from the surface of the egg. In those forms where the egg is nearly or entirely formed of protoplasm, or where the protoplasm and food yolk are evenly distributed, the nucleus occupies a position near the centre of the egg; but when the protoplasm is aggregated at one pole and the deutoplasm at the other, the segmentation nucleus is found in the protoplasmic portion, or, as it is called on account of the active part it plays in the formation of the embryo, the animal pole, in contradistinction to the deutoplasmic or vegetative pole.

The egg is, as we have seen, but a single cell, the adult animal which is to come from it is composed of myriads of cells. How do the many arise from the one? Simply by a process of division, which theoretically takes place in a geometrical progression, though in reality the regular series is interrupted at an early date. Theoretically, the series would be 1, 2, 4, 8, 16, 32, 64, 128, etc., but in reality this mathematical regularity is not the rule, and frequently the divisions are not completed until a very late stage. The cause of this variation and irregularity is not far to seek. As we have seen, each egg is made up of protoplasm and deutoplasm variously distributed, and the relations of these influence the rapidity and the character of the segmentation. The protoplasm is the active part; the deutoplasm, on the other hand, is inert and restraining. So when we have an egg with the food yolk accumulated at the centre, the surface divides first, and the deeper portions of the cell walls do not appear until a later stage. Where the protoplasm accumulates at one pole, that is the first to segment, and the planes of division do not appear at the opposite one until after some time has elapsed. The first of these types may be seen by studying the egg of most of the Crustacea, while a good example of the other will be found in the segmenting egg of a frog.

In most fishes, especially those with floating eggs, the protoplasm and the food yolk are almost completely separated, and the former alone segments, forming a little cap of cells resting upon the deutoplasm, which is thoroughly inert.

Recent investigations tend to show that the first segmentation plane coincides with the axis of the future embryo, one of

the resulting cells corresponding to the right side of the body, the other to the left. Whether this is true of all forms has yet to be determined. Attention has only recently been called to the subject, and besides, the investigation is not easy in practice—facts which account for our comparative ignorance on the subject. The second furrow crosses the first at right angles, and in eggs with an equal segmentation these first two planes of division correspond to the meridians of the globe, while the next one, the third, represents the equator. Until the third division the segmentation is much the same in all forms, but here variation becomes marked, and in succeeding stages the differences become increased.

When an egg has no food yolk, or when this element is distributed equally throughout the egg, the equatorial furrow occupies a median position between the poles, just like the equator on the globe; but if there is more protoplasm at one end than at the other, the equator is removed towards the active pole, the amount of change being regulated by the amount of protoplasm aggregated at the other.

Thus, as is apparent, a large amount of food yolk has a very important influence on the character and regularity of segmentation, and in some cases (as in most molluscs) these differences between the cells at the two poles of the egg are very great, so that the smaller ones are called micromeres, the larger macromeres. By this early difference in size the cells may be divided into two categories, a fact which in the typical segmentation does not occur until a much later date. Having now an idea of a typical segmentation, and of the causes which are productive of irregularity, we may proceed to the definitions of a few terms, and leave the more peculiar types of segmentation to be described in connection with the forms in which they occur.

The planes which divide up the original egg into cells are known as segmentation planes, and the resulting cells, before they become differentiated into the germinal layers (to be mentioned further on), are known as blastomeres. The layer of blastomeres forms what is known as the blastoderm, a term usually restricted to the cellular portion in eggs with a large amount of food yolk (like the egg of the common fowl). In

eggs with a more or less regular segmentation the result of the division is the formation of a mulberry-like mass, a spherical mass of little spheres variously flattened by mutual pressure, the morula. At first the morula is solid, but soon it grows larger, and a cavity is formed in the interior. This is the segmentation cavity, and by its appearance the morula is transformed into a blastula or blastosphere.

In the morula condition the egg is in a stage about on a level with some of those not yet thoroughly understood protozoans, like *Actinophrys*, but after we leave the Protozoa there is nothing like it to be found in the whole animal kingdom. All other animals are formed of various layers and tissues, but the morula or blastula is composed of but a single layer of cells. The next series of changes will now be described.

d. Invagination, and the Formation of the Germinal Layers.

At the time of the formation of the morula and blastula some embryos (as those of some sponges) leave the egg membrane and float freely in the water, swimming about by means of slender vibratile hairs (cilia they are called), borne on the cells. In the great majority, however, the embryo does not escape from the egg until a much later date in development.

As mentioned above, in eggs with an unequal segmentation we have from almost the first a differentiation of the cells into two groups, one smaller and containing but a comparatively slight amount of deutoplasm, those of the other group being larger and composed largely of food yolk. Theoretically this differentiation should not take place until a later date, and then should be brought about in the following manner:

To quote an oft-used illustration, the blastula resembles a hollow rubber ball, the cells of which it is composed corresponding to the rubber shell, and the segmentation cavity to the hollow of the ball. After the blastula stage is reached, the next in sequence is the formation of the gastrula. Taking our rubber ball, we can force in one side so that the result is a shallow cup with double walls. Just so in the egg, one side is pushed in, encroaching on the segmentation cavity, and the resulting cup is composed of two layers of cells, and we have the first differentiation of tissues. Each of these layers has its

proper name, or rather several names, and as students will run across all of these in their reading, we give them here. The outer of the two layers is variously called epiblast, epiderm, ectoblast and ectoderm. Which of these is preferable is a question. In the publications of English naturalists the first is usually employed, while the Germans generally use the last. By strict laws of priority the term ectoderm should be used, but if we are to have words which indicate exact shades of meaning, epiblast is preferable. The epiblast of the gastrula is something more than the epiderm of the adult, for, as we shall see, from it develops, besides the outer layer of the body, the nervous system and several other structures.

With the inner layer the same duplication of names is found, and we have hypoblast, hypoderm, entoblast, endoblast, endoderm, and entoderm. The same remarks as to which is preferable which were made in the preceding paragraph, apply here. From the hypoblast of the gastrula is formed not only the endoderm of the adult, but the epithelium of the body cavity and of the lungs, liver, and some other glands connected with the digestive and respiratory functions.

With these points in mind, it will be well to restrict the terms epiblast and hypoblast to the two layers of the gastrula, and apply the names ectoderm and endoderm to the respective derivatives which form the outer layer of the body and the lining of the middle region of the digestive tract. The others may be regarded as synonyms.

The extent of the invagination may be rather small, or it may proceed to such an extent that the segmentation cavity is obliterated. With the in-pushing the process of invagination is not completed, but the edges of the cup begin to grow together until its mouth is reduced to a small opening, which either persists through life or later becomes completely closed. This opening is known as the blastopore, and the hollow to which it leads (that bounded by the hypoblast) as the primitive stomach or the archenteron. This stage of the embryo is known as the gastrula, and the process of its formation as gastrulation.

This closing together of the lips of the blastopore brings about a difference in the size of the cells of the epiblast and

the hypoblast. Since the former have to cover a greater extent than the latter, they become smaller than the others.

PROCEEDINGS OF THE AMERICAN SOCIETY OF MICROSCOPISTS.

SEVENTH ANNUAL MEETING HELD AT ROCHESTER, N. Y., AUG. 19, 20, 21, AND 22, 1884. pp. 300. ILLUS.

A COPY of these proceedings reached us shortly after the middle of last month. A lithograph of the late Robert B. Tolles forms the frontispiece; and from those who had the pleasure of a personal acquaintance with him, we learn that the likeness is a very good one indeed. Among the more prominent of the thirty papers are the following: The annual address of the president, Hon. Jacob D.Cox, on "Robert B. Tolles and the Angular Aperture Question." This occupies nearly forty pages of the proceedings and is acknowledged by all a most masterly production. The article by Dr. Wm. T. Lewis, on "Hair, Microscopically examined and medico-legally considered," is well written and shows that the author has given a good deal of attention to the subject; but the illustrations are so poorly executed that they rather detract than add to the text. It is to be regretted that such a valuable article as this could not have been given first-class lithographs or fine wood cuts. On the contrary we have never seen finer productions from photo-micrographs than those that illustrate the paper on the structure of diatoms by Pres. Cox. They are equally as good as the prints from the negatives themselves. The article on "Silvering Mirrors" by Dr. F. L. James, contains formulas for work and all necessary directions how to proceed to deposit silver on glass and other non-metallic substances. This article has been noticed quite extensively in foreign journals and is received with great favor at home. Mr. Edward Bausch explains why it is that objectives made by one firm do not always fit into the stands made by other firms, even when both use the standard "society screw." He procured from the Royal Microscopical Society of London, three plugs or taps. They were stamped with the initials of the society and therefore were supposed to be made by the sanction of the society. However, he discovered the following discrepencies:

1. They are tapering; the variation in .5 inch length of screw being .005 inch.

2. They are not round; the difference between the largest and smallest diameter in one tap being a little over .001 inch.

3. They are unlike in diameter at their largest diameters, one measuring .8 and .003 inch, while the other is exactly .8 inch.

4. The threads do not correspond, which is evidence that either the angles vary or that they are irregular.

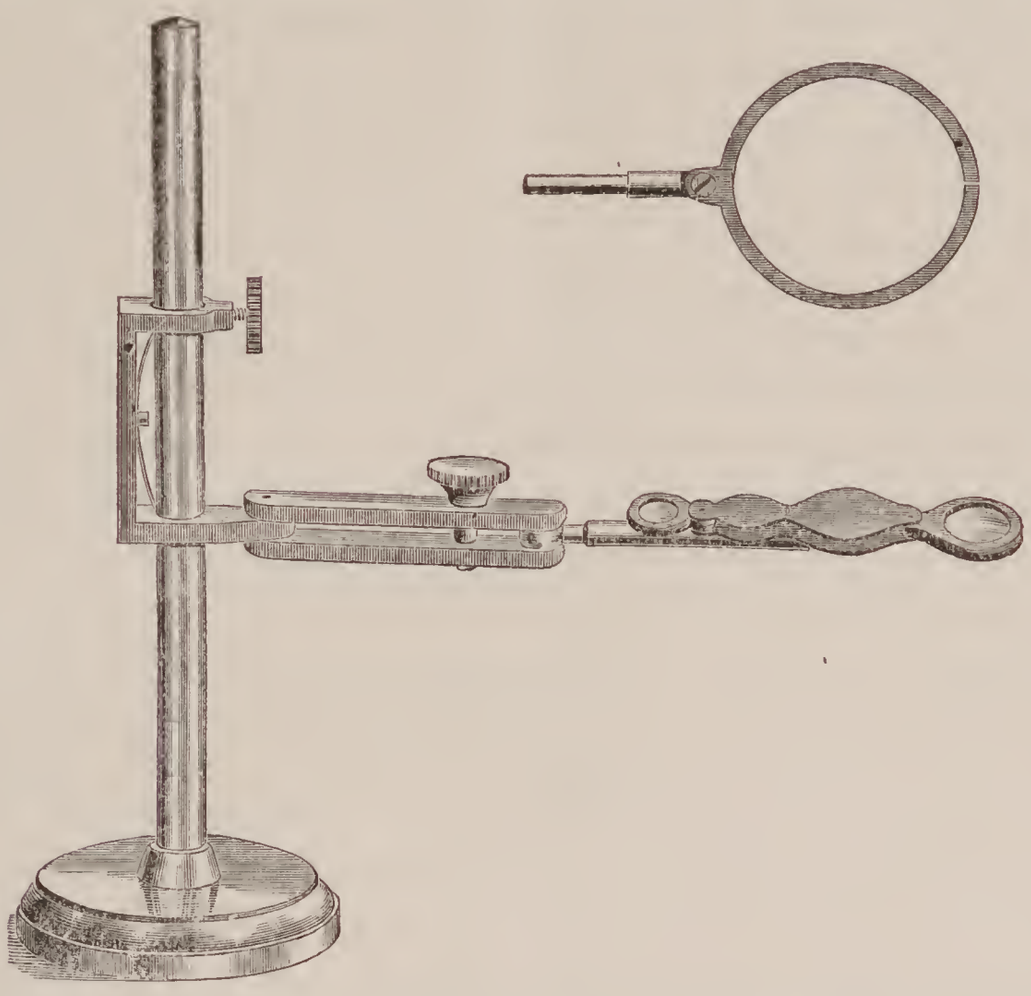
We look in vain through the "proceedings" for any report of many interesting and valuable remarks made under the head of "discussions." These "remarks" on the various papers read were many times as valuable as the papers themselves, and it was understood by many of us while at the meeting, that these discussions would be reported, even in the absence of a stenographer. Two things, finally, we wish were different: first, we miss accounts of these "discussions," as engaged in by Pres. Cox, Dr. Detmers, Prof. Lattimore, Prof. Smith, and many others; and second, we see no use in printing the matter found between pages 234 and 250. The volume appears in good paper, clear type, and shows unusual care in its editorial work. As a whole, then, we are glad to announce that the volume is above the average, and, in our opinion, excels any ever issued by the society. THE MICROSCOPE thanks the "committee on publication," and especially the secretary, Prof Kellicott, for the completion of this task, which is to some extent a thankless one.

NEW LENS HOLDER.

BY R. H. WARD, M. D., F. R. M. S., TROY, N. Y.

THE large, heavy doublets sold as "engravers' glasses" have been used with great satisfaction in the preliminary examination of herbarium specimens or of handwriting; in the selection from among large masses of material, as of fabrics or mixed fibres, or other substances supposed to contain inequalities or adulterations, the portions requiring further investigation; and in performing under the lenses such manipulations or dissections as require only a low amplification. For these purposes the writer has been led to devise and employ a stand, arranged somewhat like the stands used by engravers, which is

(unlike them) sufficiently firm and manageable for either large or small magnifiers, of low or high powers, and is available for an arm-length of 20 to 25 cm. It consists, as shown in Fig. 1,



of a rectangular frame which slips over the pillar of a bull's-eye stand, both it and the bull's-eye being best mounted upon the same stand, for the sake of simplifying the apparatus, and because they are often advantageously used in combination. The frame slides smoothly up and down the pillar, being held in any position by an included spring. To an extension of the bottom of the frame is attached a horizontal arm, having first a horizontal pivot joint, and secondly a ball and socket joint, the tension of these being readily adjustable by means of a screw with a large milled head. By bending the joints, the lens may be brought near the pillar for use in connection with the bull's-eye.

At the end of the arm rises a vertical pivot, upon which can be slipped almost any kind of pocket magnifier, such as a Coddington or achromatic triplet (which on account of its long working focus and broad, clearly-defined and well-lighted field of view may be considered rather a necessity than a luxury),

or a bellows shaped arrangement more or less like that shown *in situ* on the arm. Or, the lenses being removed, a split wire may be inserted into the hollow end of the arm, bearing a pair of hinged semi-circular jaws, shwn in the figure, for carrying an engraver's glass or any variety of large lenses not requiring delicate adjustment. For magnifiers of higher power, requiring more precise adjustment, a ring is substituted for the jaws.

There is a fine adjustment at the top of the rectangular frame, where a screw with milled head, pressing the pillar against the spring, promptly but steadily depresses the lenses to the extent of about four times its own motion.

This apparatus was made for me by the Bausch & Lomb Optical Company, of Rochester. When supplied with suitable lenses, and kept standing always ready upon the table, it becomes constantly useful, even to persons well supplied with elaborate apparatus. If transmitted light be required, the objects are placed upon the stage of any dissecting microscope that may be within reach. By turning the jaws or ring into a vertical position, it is well adapted to the examination of living organisms in a glass jar or aquarium; for which purpose powers of 50 to 100 diameters may become available by using the Brücke magnifier, or the Bausch & Lomb compound dissecting magnifier, which for this use should be screwed, not slipped, into the ring.

A NEW VORTICELLA.

DR. ALFRED C. STOKES.

PROBABLY the most interesting Vorticellæ, all of which are attractive, are those species whose surface is ornamented by bead-like elevations, as in *V. monilata*, Tatem, by a cellular covering, as in *V. vestita*, Stokes, by ovoid, nucleated elevations as in *V. Lockwoodii*, Stokes, or by some other curious and unexpected decoration. Nature seems to have had a special fondness for these active little creatures and to have taken special care in embellishing them and rendering their elegant forms more beautiful by what may not inaptly be called infusorial sculpturing.

But the most remarkable of these cuticular additions thus

far noticed I have recently observed on an undescribed species of this favored genus, where the body is clothed by what seems to be a mucilaginous investment crowded by slightly curved bacilliform rods. This delicate coating is, in those individuals most abundantly supplied, usually much deeper than the width of the spaces between the transverse striations which also orna ment the zooid, and the curvilinear, bacteria-like bodies are densely distributed over the surface, appearing, when the Vorticella is seen in optic section, like minute, solid, refractive nodules scattered through this external film. These delicate rods are extremely minute, measuring only $\frac{1}{12000}$ of an inch in length, and are visible only to a magnifying power of 500 diameters obtained by a good objective, while the mucilaginous investment, if it is of that nature, is easily apparent with so low a power as a $\frac{4}{10}$ inch glass. The bacteriform bodies are usually extremely abundant, being scattered, or arranged in irregularly disposed clusters formed of several rods lying parallel to each other. Occasionally the enclosing film is very scanty, the curved rods then being correspondingly few and scattered, and noticeable only at wide intervals on the surface, or along the borders when the zooid is seen in optic section. On other individuals the film may be abundantly developed and irregular in thickness.

The body is quite changeable in shape while on the microscope stage. I am inclined to believe that in its native waters, with congenial surroundings it is not specially polymorphic. My supposition is based upon the observation of a few individuals which remain unchanged to the end of prolonged examination. The rule is, however, that after a few moments, occasionally even before the cover-glass can be applied and the Vorticellæ transferred to the stage, they lose their normal outline. Whatever they may be in their chosen haunts, they are peculiarly sensitive to influences beneath the cover, speedily showing evidence of being ill at ease. The body becomes variously distorted, the ciliary disk finally becoming much raised and dome-like, the creature assuming a subglobose form, while the striations grow gradually fainter, the external coating with the bacilliform bodies remaining distinct almost until diffluence takes place. The curious animalcules were quite accidentally

obtained from a vessel in which water had been standing for several weeks on some dead leaves, the water coming from the Delaware river, the leaves—ask the winds. The following description probably contains the essential characters:

Vorticella rhabdophora, sp. nov. Body elongate, changeable in shape, somewhat gibbous, usually obliquely attached to the pedicle, about twice as long as broad, tapering posteriorly, widest at the anterior border, beneath which it is somewhat constricted; the cuticular surface finely striate transversely and also entirely clothed by a delicate, apparently mucilaginous, investment, crowded with short, slightly curved, bacteria-like bodies, which, in transverse optic section, have the aspect of minute, solid nodules; peristome border everted, slightly revolute; nucleus long, band-like, curved, one arm usually extending across the frontal region, and occasionally traversing the ciliary disc; pedicle commonly less than twice the length of the body; endoplasm colorless, granular. Length of body $\frac{1}{500}$ inch. Habitat. An infusion of leaves.

The Vorticella is shown in Fig. 1, where the bacteria-like bodies are much more magnified than the infusorian, the representation being therefore somewhat diagrammatic. Fig. 2 is a diagram of one side in optic section.

A SIMPLE COVER COMPRESSOR.

DIVIDE a small cork transversely and cut a notch in one end of one of the pieces. Pass an ordinary stationer's rubber elastic ring over the end of the slide; put the piece of cork under it, the ring resting in the notch, then draw it along until the under side of the ring will rest under the point to which the pressure is to be applied, then lower the cork on the cover. If more pressure is desired a second ring may be placed over the first. Pieces of cork of different lengths give more or less pressure and those of different diameters apply it over more or less space; the slides can be laid away side by side.

J. J. DAVIS.

AN INSECTIVOROUS PLANT.

KITTIE H. REYNOLDS.

IN the *Popular Science Monthly* for July, 1883, our common garden petunia was spoken of quite positively as an insectivorous plant, and I appointed myself detective to ascertain whether or not we were harboring in our garden a plant with this murderous propensity.

I observed with the naked eye that most of the stalks of the petunia seem to be covered with minute bits of dirt. I selected one of the dirtiest looking stems, and placing it under the microscope, found that, while there were some particles of inorganic matter caught in its sticky hairs, the majority of the dark specks were, in reality, diminutive insects in all stages of intoxication, death and decay. There were flies, spiders, and various plant pests, some struggling, some dead, and numbers reduced to dry skeletons. Those which were still living really seemed to be prevented from stepping about very lively by something sticky on their feet.

The hairs of the petunia are naturally erect, slender, and tapering, and each bears at the top an egg-shaped gland. Where the insects had stepped the glands were flattened, or sometimes drawn out into sticky threads, and the hairs were broken or bent.

A little fly walked across the table, and I escorted him to the stem under the microscope. Before many seconds he began to lift his feet like a boy on stilts. Though I watched closely, I couldn't see that the hairs became excited and moved spontaneously, as was stated in the article which incited my inquiries. The fly raised his feet and burst the glands, setting free their viscid secretion. He fluttered his wings, with the same result. Then he put down his feet and folded his wings, and they stuck fast. Often in his struggles different parts of his body became glued to the hairs themselves, and he dragged them after him. This gives to some of the dead insects the appearance of having been forced down and held by the hairs; but their imprisonment seems to be the result of their own movements. The more they struggle, the greater the number of glands which they burst and the more firmly they are pinioned.

After a few hours my fly began to get stupid; whether this was the result of some influence exerted by the secretion, or of his violent and continued struggle, it was impossible to tell. It was probably, however, the former, as four or five more hours of intermittent, spiteful pushing and jerking ended in his death, and this could scarcely have resulted from his being worn out with his efforts to free himself.

Since that day dozens of bugs have followed in his footsteps, and the result has always been substantially the same. They all die; some in a few hours, while some live days.

Of course, we cannot positively conclude that the plant has need of the insects and absorbs nourishment from their bodies; but it *does* detain and kill them; and from the presence of so many dry skeletons it is easy to infer that the nitrogenous matter contained in their bodies is sucked in for the use of the plant. Also from the numbers of insects found on all the stems and leaves, it is inferable that some attraction is exerted by the peculiar perfume of the secretion.

THE CHOLERA BACILLUS.

BY J. M. ADAMS.

I HAVE lately received a remarkably good slide of this interesting object from our microscopical friend, W. J. Simmons, of Calcutta, which he obtained with great difficulty from an assistant of Dr. Koch, who in order to get a genuine specimen applied the cover glass to the mucous lining of the intestine of a cadaver.

Upon examining this specimen it is observed that the mucous corpuscles are very numerous and irregular in form; nearly all appear to be ovoid, distended, and finally broken to pieces. The fresher corpuscles are more or less filled with long oval or oblong cells, with ends lightly attached, regular in form and size, and arranged in lines or rows about the outer edge, but interior sometimes in semi-curved chains, and more frequently crowded together heterogeneously, completely filling the corpuscle. These peculiar, prolific cells or bacilli, finally burst and destroy the corpuscles leaving now and then shreds with bacilli attached, still arranged in rows not having been separated.

Most of the bacilli when freed from the corpuscle, become separated singly, and float about in the fluid in a somewhat changed and more matured existence. Shreds of the mucous lining membrane also appear having these same bacilli attached or within it, but not as extensively as in the corpuscles.

Occasional patches of minute micrococci appear, or perhaps the spores of bacilli, yet such spores are not apt to leave the old cell.

The bacilli, at first, in the corpuscle, appear more regular in form and size, being long-oval or oblong, and the transverse line of division if hardly distinguishable, being so very small, yet if bacilli, this must exist. The minuteness of the cell may be compared with *B. termo* or *M. ureæ* although smaller than either, being about 1 *m* in length or a little short of it, and about two-thirds as thick. It is the shortest of any of the bacilli and thicker than any of the smaller kinds, though not as thick through as the largest. The extreme minuteness makes it a difficult object to examine, to say the least; yet after all quite plain. When the bacilli are set free from the corpuscle being bursted and destroyed, they change their shape considerably, becoming more obtusely oval and enlarged at one end, and comma pointed at the other. Tho comma point is very short and not always curved with the same angle; the enlarged end probably has its spore at this stage. It is presumable that the bacilli in this condition have some peculiar wriggling or whirling motion.

The cell covering of the bacilli appears to be quite firm and tough and may not so easily be destroyed unless more absorbent than most of the bacilli. It ought to reflect light as well as the *B. termo* and might be seen without staining, although it takes the analine colors readily and staining is essential. It is unlike any of the micrococci, resembling in part in its early period the *M. bombyces* or an oblong *M. septicus*, yet even then much more elongated and finally becoming dissimilar in every respect to any of the micrococci. It cannot be classed as a spirillum as it never has a complete spiral and is much shorter and altogether different from any known form. It does not in any way resemble any sporular growth of fungi known as such judging from the specimen at hand. It seems to be identical in itself as

to its form and habits, and is easily recognizeable from all other forms. It is intensely parasitic and wonderfully prolific among the mucous corpuscles.

THE WORKING SESSION OF THE AMERICAN SOCIETY OF MICROSCOPISTS.

THE Executive Committee of the American Society of Microscopists having appointed me Director of the Working Session of the Society at its next meeting, and placed in my hands the arrangement of the work and details of the session, I have prepared the following scheme of work to be illustrated in the Working Session at the meeting of the Society in Cleveland next August. The general theory of the plan is to illustrate methods of research in the main, leaving the details which are merely matters of mechanical execution to be treated as subsidiary matters, since the available limits of the Working Session are insufficient to fully cover the whole ground at any one meeting.

The plan is submitted, not as being complete or approaching perfection, but as covering nearly all that can be well illustrated at a single session within the limits of time and space at present available.

SCHEME OF DEMONSTRATIONS.

1. The use of the Micro-Spectroscope and its applications to original research.
2. The utilization of the Polariscope in original investigations.
3. Micro-photography, and its applications as an aid to research.
4. The use of the Camera lucida, various styles and methods.
5. Micrometry; illustration of different methods.
6. Cultivating Bacteria, exposition of different methods.
7. Injecting vessels and tissues, exposition of different methods.
8. Staining tissues, etc., in mass. Simple and compound stainings.
9. Staining sections. Simple and compound stainings.
10. Section cutting—soft tissues. Use of various microtomes.
11. Section cutting—hard substances. Methods of cutting and grinding.
12. Section cutting. Serial sections.
13. Use of the Dissecting Microscope. Methods and apparatus.
14. Practical demonstration of the relation of aperture to power in microscope objectives.

15. Methods of manipulation, decantation, desiccation, isolation, etc.

16. Methods of measuring aperture, power, focal length, etc.

17. Methods of illumination for special purposes, special objects, etc.

18. Uses of the Mechanical Finger. Application to research, etc.

19. Electrical and thermal applications in research. Hot stages, etc.

20. Uses of Tin Boxes. Growing cells, compressoriums, troughs and special apparatus for investigations of special objects, etc.

21. Special methods of treatment or examination of special subjects of investigation, such as Blood, Pus, Urine, etc., etc.

22. Staining and mounting Bacteria, micrococci, etc., for examination.

23. Special methods of cell-making, cementing, cover-cutting, etc.

24. Special methods of mounting, labelling, finishing, packing, storing or registering slides. Finder records, etc., etc.

It is expected that one or more workers will illustrate each of the above subjects. Many of the most efficient members of the Society have already promised their co-operation. Suggestions relating to the work in any respect are invited, and all who are willing to aid in illustrating any of the above, or other subjects not enumerated, are cordially requested to inform me as soon as possible what part of the work they will undertake, and communicate such information as may be needed in preparing for the suitable presentation of their exhibits.

C. M. VORCE,
164 Lake Street, Cleveland, Ohio.

A MICROSCOPIC GEISSLER TUBE WITH FLUORESCENT SOLUTION.

DR. ALLEN Y. MOORE, of Cleveland, has constructed a microscopic Geissler tube about one fiftieth of an inch in diameter and one-half inch in length. Platinum wires are soldered into the ends, and the tube contains rarified air. Around the tube is a fluorescent solution, and the whole is mounted in a wooden slide 3 by 1 by $\frac{3}{8}$ inches. It is the very latest and handsomest production brought before the microscopical world.

C. H. S.

COMMUNICATIONS RELATING TO THE WORKING SESSION.

LETTER FROM DR. J. O. STILLSON, INDIANAPOLIS, IND.

"Upon what meat doth this our Cæsar feed
That he is grown so great?"

I see by the Jan. No. that our late ex-President McCalla feels himself called upon to inform the world that he "invented" the working department of the American Society of Microscopists. Why did he wait till somebody else brought out of chaos and uncertainty the systematic and valuable work which made the Rochester meeting alone worth going so far to see? My dear Professor, I feel pained to see in print such a large perpendicular pronoun and to realize that said third vowel was once the president of our society, which, above *all things*, should be free from such petty jealousies and Lilliputian efforts at greatness. Let me assure you personally that I had frequent conversations with the gentleman who conducted the working department of the Rochester Meeting, on the subject and plans for starting and keeping alive such a feature *as long ago as 1879, I am sure*, and I think in 1878. It was his personal effort and promise in this respect that was the principal reason for my going to the Chicago meeting. I remember already distinctly such efforts to have been made by him at the Elmira Meeting, and the perfection and success of the feature at Rochester was simply the outgrowth of personal effort that had been made at great expense, both of time and money, neither of which I dare say Prof. McCalla contributed.

The superintendent of the Rochester Working Department asked me personally and by letter several times to assist in work, and I for one am perfectly astonished at the tone of the article in the January No. of the Microscope. Our late honored president may perhaps in his conscience feel clear when he makes the claim, but to me it seems like a fearful struggle with the truth.

LETTER FROM REV. F. W. TAYLOR, DANVILLE, ILL.

I must confess to no small degree of surprise at the claim of Prof. McCalla to be the *fons et origo* of the

Working Session of the A. S. M. As far as I am acquainted with the facts, and I believe I am pretty fully conversant with them, not only the *idea* but also the *actual organization*, was the work of Mr. Griffith. I am aware of the fact that sometime before I became a member of the Society, he had been trying to see the reality of some such scheme. At the Elmira Meeting he, and a number to whom he had often spoken upon the subject, desired to hold such a session, but there was neither opportunity nor encouragement given for it. At the Chicago meeting those who were interested in the matter determined to break through the diatomaceous crust of learned treatises and to traverse the mighty seas swarming with all the new species of polysyllabic wrigglers which abound in the foaming Niagara, and have a *start* at the Working Session anyhow. The thing was done, not with the cordial coöperation of all the officers and members of the Society, although we had the good will of Pres. McCalla, but it was done because we felt that if this meeting went by without any move towards the realization of the idea, then the idea was consigned to everlasting burial among those microscopic fossils which no objective yet made can resolve. "Uncle Ezra" may remember how discouraged he was at Chicago because of the coldness with which all his efforts for a working session was seconded by certain officers and leaders of the Society, and how a friend of his had a rather excited little discussion with him, urging him not to recede from the attempt after all his past labors on its behalf. The following day I made a few pointed remarks in support of the Working Session as a permanent feature, which were received with favor by those present, and drew a half-supporting, half-apologetic, reply from the president. (See Jour. Chicago Meeting, p. 260.) I know that Mr. Griffith saw personally, during the previous two years, nearly everyone interested in the Working Session; that he wrote numerous letters to them on the subject; got each one to take up some specialty of work, mounting, etc.; supplied a great deal of material; and, finally, came to Chicago with a ponderous load of microscopes and material, a head full of ideas, and a heart full of enthusiasm for the Working Session. And I am quite certain that those who were interested in this matter will have recollections of it similar to my own.

LETTER FROM W. H. BREARLEY, DETROIT, MICH.

The article in the last MICROSCOPE upon the Working Department of the Rochester Session, does an injustice to Mr. E. H. Griffith.

Fortunately I am able to give specific and conclusive information upon the subject of who originated the Working Department, and am pleased to know that the wisdom of the suggestion was not only demonstrated at Rochester, but is confirmed by this controversy as to who had the honor of its origination.

In August, 1880, the American Society of Microscopists met at Detroit, and as secretary of the Griffith Club of this city, I was active in arranging for the session. As early as the preceding April, Mr. Griffith came to me and advised our attempting to have a Working Department as one of the features of the approaching session. He explained his conception of the plan, substantially as carried out at Rochester last summer.

At his suggestion I corresponded with Prof. Hamilton Smith (the president) and with Dr. Ward, of Troy, asking to be allowed to make the needed local arrangements, and explaining Mr. Griffith's plan at length. They replied in letters that are now on file with the secretary of our society, that our meeting was not to be a school, and that they thought this annex would be undignified for a society of specialists. I showed these letters to Mr. Griffith the next time he came to Detroit, and he remarked, "Of course that settles it, but it don't change my conviction that such a department is desirable, and I shall keep stirring the matter until we have it." That he *has* "kept stirring it," I have had proof in frequent conversations since that time, and have often remarked to myself the persistency of his determination to sometime secure this department as a feature of our annual session. *If Prof. McCalla originated the Working Department he must have done so before he became a member of the National Society*, as he was received into membership at the Detroit meeting. Mr. E. H. Griffith has been indefatigable for years in his labor all over the country in the interests of our annual sessions, and to him more than to any other one man I feel the present prosperous condition of the society is due.

LETTER FROM C. M. VORCE, CLEVELAND, OHIO.

I am pained to observe that Prof. McCalla in the January

MICROSCOPE has revived a controversy I had hoped was settled, regarding the proportion of credit due to himself and Mr. Griffith respectively, for the incorporation into the American Society of Microscopists of the "Working Session" as it is now called. I was present at the Illinois "Congress," and was chairman of the committee by which the present Society was organized, and I know personally that before the existence of the American Society, Mr. Griffith suggested to myself and others that practical demonstrations of the papers read would be a valuable feature of the meetings, and this idea he has to my knowledge constantly and persistently urged ever since, aud for some time before Prof. McCalla joined the Society.

The whole truth in a nutshell is just this. Mr. Griffith originated, or at least first expressed, the idea and constantly urged it upon the members, with increasing elaboration, as was natural, but he had no power to force its adoption by the Society, and seems not to have been able to influence the officers of the Society to adopt his idea. When Prof. McCalla, in his third year of membership, found himself in authority as President, he had sufficient influence to secure the adoption by the Society, through its executive committee, of Mr. Griffith's idea, and it was done; and by the joint labors of Pres. McCalla and Mr. Griffith (in which respective proportion I don't know) the Working Session of the Chicago Meeting was organized and carried out. Then, when the idea had been adopted and set firmly in place as a part of the Society's work, Mr. Griffith was delegated to organize and direct that part of the work at the Rochester Meeting and did so. But for his positive refusal to continue longer in charge ne would still be in charge of the work, and it seems clear to me that the true division of the credit is this: To Mr. Griffith alone belongs the credit for the origination of the idea of a Working Session, and to Prof. McCalla in chief and in part to Mr. Griffith, is the credit due for securing its adoption by the Society; for had not Mr. Griffith's long-continued urgency preceded Prof. McCalla's official recommendation it is not likely that his recommendation would have met with such speedy and encouraging recognition.

[We are in receipt of other letters similar in tone to the above; but the positive and clear statements of Mr. Brearley

and Mr. Vorce, carry the matter back to such an early date that other proof would only furnish accumulative evidence without eliciting anything new.—ED.]

REVIEWS.

PLANT ANALYSIS. Qualitative and Quantitative. By G. Dragendorff, Ph. D., Professor of Pharmacy in the University of Dorpat, Russia. Translated by Henry G. Greenish. Published by J. H. Vail & Co., New York. 1884. pp, 280. Price, $2.75.

This work includes the detection and estimation of the active principles of plants. It includes the micro- as well as the macro-chemical analysis, and embraces all the widely distributed vegetable substances, as well as some of the rarer ones. There is a full table giving the percentage composition of the constituents of plants, and also a table giving the percentage of carbon. The author states that the methods for plant analysis are at present so complete that in point of accuracy they are fully equal to those used for the determination of mineral constituents. In fact, he says that "the analysis of a plant can often be made more complete than that of a mineral." The work is complete and exhaustive.

THE CENTURY.

The February number of this interesting journal reaches the enormous number of 180,000 for the first edition. The main article that will excite the interest of the reader is by General Grant, on "The battle of Shiloh." The illustrations for this article are superb, and show the triumphs of wood-engraving. It is doubtful if a more interesting number of a popular journal was ever issued. In proof of this it is sufficient to say that within a week after the appearance of this enormous first edition, it was all sold; and a second edition of 20,000 copies has just come from their press.

THE JOURNAL OF THE NEW YORK MICROSCOPICAL SOCIETY.

This publication appears before us for the first time. It contains the transactions and proceedings of that vigorous organization, and is to be published in nine monthly numbers, from November to July inclusive. It is printed on good paper, shows careful editorial work, and promises to give valuable aid

in disseminating the facts revealed by the microscope. We welcome such a journal to our table, and call the attention of our readers to its value. Some of the subjects in this number are: Electrical illumination in microscopy; Some facts relating to pollen tubes; Proceedings; Miscellanea, etc.

MR. GEO. E. DAVIS says: "We have never found the so-called instantaneous changers to enable more work to be done, and we have even discarded the double nose-piece in ordinary work."

MOUNTING FRESH-WATER ALGÆ.—"After trying all sorts of media . . . . I came to the conclusion that none were so good as plain water with the least addition of camphor water to prevent fungoid growths." Also suggests to preserve the green color (1) the use of water recently boiled and then closed up in a flask to minimize the amount of air dissolved in it; (2) to put the slide in the dark immediately after mounting.

DR. ALLEN Y. MOORE'S SLIDES.—Mr. J. Mayall, Jun., said that Mr. A. Y. Moore had forwarded a slide of *Amphipleura pellucida* which was worth remark. It looked as if the diatoms had been burned on the cover-glass in the usual way, and that then a coating of silver had been deposited upon them. The object gave the strongest and best image with the vertical illuminator that he had ever seen. He could not explain why it was so without further examination; but Mr. Powell had brought a microscope for the purpose of showing it, so that the Fellows would have an opportunity of examining it for themselves. Mr. Crisp said that the slide was no doubt mounted in the way recently published by Mr. Moore, viz., by coating one side with pure silver, increasing its visibility more than four times.—*Royal Mic. Journal.*

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

SEVERAL Photographic Instruments, list of photo California Views, on paper 5x8, or stereo, or same on glass for magic lantern; upwards of 100 oil, four-inch paintings of foreign scenes, for lantern; to exchange for good microscope stand and accessories, slides, etc.
R. E. WOOD, St. Helena, Napa Co., California.

WOULD like to exchange a 1-6 Objective, 168°, adjustable, for a lower power.
A. Y. MOORE, 89 Prospect St., Cleveland, Ohio.

QUEEN'S New Sub-Stage Condenser, with dividing combination for high or low powers, and three Caps, for sale or exchange. DR. A. C. STOKES, Trenton, N. J.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

WANTED—To exchange, an $35.00 Caligraph, almost new, or an Anthony's Amateur Camera, for a new or second-hand Microscope. W. C. GORMAN, Randolph, New York.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FRESH-WATER ALGÆ, nearly all genera, and many beautiful varieties; also Euglena, Astasia, etc., for good pathological or other interesting slides. Lists exchanged.
J. M. ADAMS, Watertown, N. Y.

WOULD like to exchange a 1-6 Bausch & Lomb patent adjustment (glycerine front) objective, almost new, for a 1-4 of moderate angle. C.B. HIGBY, Mokelumne Hill, Cal. Co., California.

WANTED—Diatoms on Algæ, from the Sandwich Islands, California coast, and other tropical sea coasts. Will give in exchange either very good mounted micro-slides or cash, for good material. J. C. PRINNBOCH, 14 Simmering, Wien, Austria.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

HISTOLOGICAL mounts to exchange for other good slides.
T. B. STOWELL, Ph.D., Cortland, N Y.

HISTOLOGICAL SLIDES, very thin and evenly cut, well mounted and well ringed, will be exchanged for Pathological or Histological slides only.
H. L. WHITNEY, M.D., German Hospital, Philadelphia, Pa.

WALMSLEY'S Photo-Micrographic Camera and Plate-Holder, together with the Chemical and Printing Outfits, and a Darlot's Focusing Glass, for sale. Also, Sidle's Iris Diaphragm, with society screw for sub-stage; Beck's 1 in, and ½ in. Objectives (National); Bausch & Lomb's 2 in. Objective. F. J. SCHAUFELBERGER, M.D., Fostoria, Ohio.

TO EXCHANGE—A new and perfect copy of Leidy's Fresh-Water Rhizopods of North America for a good ¾, ⅔, or ½ in. Objective. T. B. JENNINGS, 78 Major Block, Chicago, Ill.

FOR SALE or exchange, a Taylor Freezing Microtome.
F. O. JACOBS, Newark, Ohio.

FOR SALE. CHEAP—A Bausch & Lomb Dissecting and Compound Microscope (as figured in their Catalogue, p. 6); has a Wales dividing objective ½ to ⅔, two simple lenses 1½, hand rests, eye shade, etc. GEO. TIMMIN, Syracuse, N. Y.

WILL GIVE a good bargain in micro-objectives, new, made in 1884, for a Morrison *wide angle* view lens, for 5x8 or 6½x8½ photo-plates. Write for particulars.
JOHN D. WHITE, Chicopee, Mass.

WANTED—A good Zentmayer Stand. Second-hand Bi- or Monocular cheap, for cash. Address M. KAISER, 424 Sycamore St., Buffalo, N. Y.

W. R. MANDEVILLE, M.D., of New Orleans, La., 483 Magazine St., has for exchange or sale a number of first-class mounts of Pathological Specimens, including Yellow Fever, Leprosy, and various Bacteria; also a large number of miscellaneous objects.

FOR EXCHANGE—A Gundlach 3 in. 11°: a Gundlach ¾ in. 27°; a Gundlach No. IV. (⅓) 55°; a Geo. Wales 1¼ in. 25°; a Paraboloid, cost $7.50; all in good condition. Wanted, a ½ or 4-10 spy-glass, or good condenser. C. OUDERDONK, Rugby, Tenn.

DIATOMS ON ALGA. Achnanthes bevipes, etc. Polycistana, Fossil Diatoms, etc. Sertularia Pluma, Sertularia Crustata, etc. Spore cases of Fern too numerous to mention, to exchange for well mounted objects. WM. FARNELL, Macon, Ga.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

EXCHANGE.—Untreated diatoms and miscellaneous material in large variety, to exchange for good prepared material for mounting of any kind. M. A. BOOTH, Longmeadow, Mass.

EXCHANGE.—I have about one hundred lantern slides to exchange for microscopical apparatus (object-glasses), etc. W. S. WHITE, 128 and 130 Main St., Kalamazoo, Mich.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

FOR SALE.—Slides, double stained, of Bacillus Tuberculosis, 50c. each.
DR. W. R. CHITTICK, 83 Lafayette Avenue, Detroit, Mich.

WANTED.—Books treating on microscopical and histological subjects not already in my possession. Will pay cash, or give slides in exchange. State name of the work, date of issue, and price. C. H. STOWELL, Ann Arbor, Mich.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

WILL exchange mounted slides of various crystals, diatoms in situ, stellate hairs of plants and micro fungi, for other good slides or material. JAMES E. WHITNEY, Rochester, N.Y.

PATHOLOGICAL, Histological, and other well mounted slides will be exchanged for mounted specimens of interest. Lists furnished on application.
D. E. HAAG, M.D., Liberty Center, Henry County, Ohio.

THE MICROSCOPE.

VOL. V. ANN ARBOR, MARCH, 1885. No. 3.

RESULTS OF MICROSCOPICAL RESEARCH.

EYES IN CHITONS.—Among the Molusca is a curious group known as chitons. They are flattened and oval, and their dorsal surface is covered with eight shelly plates, arranged one after another in a longitudinal series. In every text book the chitons are said to be blind. Professor Moseley showed last August that this was a mistake, and now we have (Q. J. M. S., xxv., p. 37) his complete paper, illustrated by three double plates. In all genera the dorsal plates are covered with pores of two sizes, and in many forms there are, besides, eyes provided with cornea, lens, iris, and retina, composed of rods and cones; the relations of the retina to the nervous supply being much the same as in most Mollusca, and entirely different from that in *Onchidium* and the vertebrates. The pores are filled by sense organs, and Professor Moseley, with reason, regards the eyes as modifications of these. The eyes are exceedingly numerous in some forms, and the author estimates that in *Corephium* there are between 11,000 and 12,000 eyes in good condition. Professor Moseley gives an account of the distribution of the eyes and pores in various species, and suggests that they may afford good systematic characters.

SOME POINTS IN FISH EMBRYOLOGY.—From having been a sadly neglected field, the study of the development of fishes has recently acquired great prominence, but so greatly modified are the teleosts, and so widely removed from the main vertebrate stem, the interpretation of the facts they present is a matter of no little difficulty. Several years ago Küpffer, a German naturalist, described in the embryo of a fish, a peculiar vesicle the relationships and homologies of which were far from obvious. This has since been called Küpffer's vesicle. Mr. J. T. Cunningham (Q. J. M. S., p. 1, 1885) has essayed to solve the

problem, and claims that it is the rudiment of the primitive gastrula cavity, a conclusion not in the slightest warranted by facts. He also discusses some points of vertebrate morphology, but failing to understand the process of gastrulation in the teleosts, he succeeds no better here. His account of the origin of the eye of the vertebrates, is really that of Lankester, and adds nothing to it. It does not even attempt to explain the difficulties pointed out by Balfour.

Mr. George Brook, jr., in the same number with the paper by Mr. Cunningham, attacks another fish problem, that of the origin of the hypoblast. He would deny the existence of any invagination of the primary cell layers to form the hypoblast, but derives that layer wholly from the parablast or intermediary layer.

In a second paper in the same journal, to be noticed bye-and-bye, Mr. Cunningham returns to the fishes, and one sentence may be quoted. Referring to the formation of the polar globules, and the spindle formed in connection with them, he says (p. 132): "As is well known a direction spindle has been sought in vain in the ova of vertebrates, and the expelled elements in these are not globular in form. Hoffman alone has described an amphibaster de rebut [polar globule spindle] in Teleostean ova, but has not traced its history." In his first paper Mr. Cunningham showed himself acquainted with the papers of Kingsley and Conn and Whitman and Agassiz on the development of the teleosts. Had he read them or the various papers of Ryder, carefully, he would have seen that his statement is all wrong. There is a direction spindle, its history has been traced, and the polar globules in the teleosts are spherical.

A NERVOUS SYSTEM IN SPONGES.—Dr. von Lendenfeld has discovered in some of the calcareous sponges cells which he regards as sensory in function. In his preliminary account (Z. A. viii., p. 47, 1885) he describes them as forming a ring in the walls of the pores of the Sycones, and distributed in bunches irregularly over the surface of the Leucones. These sensory cells are long and fusiform, and are arranged at right-angles to the surface; they are also said to be mesodermal and do not appear as modifications of the ectoderm, a conclusion which is at variance with the sensory element in other groups. His

method of research may be given: (1) Osmic acid until the sponge is dark brown; then wash and place in 33 per cent. alcohol; then picrocarmine. (2) Absolute alcohol; wash; alum-carmine. (3) Corrosive sublimate solution, 40 per cent.; hæma oxylin. The sections must be very thin.

How a Hydroid Attaches Itself.—Dr. W. K. Brooks describes (Z. A. vii., p. 709, 1884) an interesting feature in the development of *Eutima*. It forms a planula as usual, the process of the origin of the endoderm (by delamination) being readily seen in the living embryo. Then an invagination occurs, which, were one unacquainted with the whole history, would be interpreted as the formation of a gastrula; but in reality this is but the formation of a cement gland which is to secrete the substance by which the young hydroid is later to attach itself to some submarine object.

Those who are interested in the common fresh-water *Hydra* will find some interesting facts regarding its method of fixing itself, and the way in which it walks, in a paper by Hamann in the Janaische Zeitschrift, some three years ago. This author describes cells at the base of *Hydra*, which send out pseudopodia very much like those of *Amœba*, and by means of these, just as an *Amœba* walks the hydroid is able to change its position.

A Case of Symbiosis.—One of the most peculiar of animals is the worm (?) *Phoronis*. Its development is very remarkable. At one stage it develops a larval form known as Actinotrocha, and this changes into the adult by apparently turning itself inside out. An Australian species of the genus, recently described, lives in colonies, each individual forming a tube in the soft sea bottom. These tubes are usually arranged around a large sea-anemone, so that it also lives in a tube. This doubtless is of great advantage to the worms as the thread cells of the anemone kill food for them.

In Australia a peculiar insect has just been discovered. It belongs to the same family as our familiar forms known as spittle insects, but its peculiarity consists in the fact that the larva constructs a case which is largely composed of carbonate of lime, and which in shape resembles the cases of the worms known as *Serpulæ*.

NEW PROTOZOA.—Dr. O. Nüsslin has recently described (Z. w. Z., xl., p. 697, 1884) four new Protozoa. *Zonomyxa violacea*, *Vaginicola bütschlii*, *Epistilis ophrydiiformis* and *Amphitrema stenostoma*, from the fresh-waters of Germany. He also adds some notes upon the encystment of *Amœba*. His account is detailed, and embraces the life histories of the forms described. *Zonomyxa* is a new genus placed near *Amphizonella* and *Pelomyxa*, among the Rhizopods. It resembles the former in its pseudopodia, color and envelope; it agrees with the latter in the vacuolation of the protoplasm, size and structure of nucleus, etc.

Prof. E. Ray Lankester describes a new genus belonging to the Monera, under the name *Archerina* (Q. J. M. S. xxv., p. 61, 1885). It has no nucleus, but in its place a nucleus like chlorophyl corpuscle. It forms large colonies and lives (in England) among desmids and other chlorophyl-containing algæ. Prof. Lankester maintains that this is not a case of symbiosis, that the green is not a plant living in full sympathy with a protozoon.

Frederick, Count von Stein, the celebrated zoologist and author of the valuable work Die Organismus der Infusionsthiere, died at Prague January 9th, at the age of 67. He was a most careful worker, and his drawings of the minute animals which were his favorites, have never been excelled in grace or accuracy. His views upon the relationships of these forms were based upon a thorough knowledge of their structure and life history, and American students of the Infusoria would do well to follow his guidance rather than the more commonly-quoted manual of Saville-Kent, a work which does not well bear criticism.

THE junior editor acknowledges the receipt of a most elegant self-centering turn-table; the gift of the inventor, Mr. E. H. Griffith. It is an improvement of the form illustrated in the catalogue of Messrs. Bausch and Lomb, under No. 1245. It has an extra attachment for *decentering* the slide, at once simple and convenient.

SELECTIONS.

A FEW HINTS ON HARDENING, IMBEDDING, CUTTING, STAINING AND MOUNTING SPECIMENS.

BY GEO. DUFFIELD, M. D., DETROIT, MICH.

The rule I follow in the hardening of specimens is briefly this: I cut the original specimen into pieces, not exceeding three-quarters of a cubic inch, and put them in alcohol to remain there from six to eight days; they are then placed in 95 per cent. alcohol for a day or two, until they have become firm, which is easily seen by pressing them with the fingers.

As soon as the specimen has become firm, a cork cut square or rectangular, with smooth surface, is prepared. The specimen is noted and numbered in a book, kept for that purpose, and the same number is put upon the side of the cork, opposite which the specimen is to be placed. The specimen is secured to the cork in this wise: A thick solution of powdered gum acacia is made; a thin film is put on the cork. The specimen having been previously washed in water and dried, is placed upon the gummed cork and gently pressed down so as to expel all air-bubbles that might be between the specimen and the cork. Let the specimen stand a few moments in the air, then put a teasing needle into the cork, and submerge the cork and specimen, keeping the specimen "butter side up," in alcohol. Allow it to remain this way for four or five minutes until the gum becomes set, then remove the specimen from the alcohol, and with a knife remove the gum from the sides of the specimen. Then drop it, "butter side down," into a wide-mouthed jar, containing 60 per cent. solution of alcohol, and let it remain for six to twelve hours, after which it will be ready for cutting.

There is a new method of imbedding, far superior to albumen or paraffin methods, which I can recommend from personal experience. It is called the celloidin method. The celloidin is manufactured by Shering of Berlin, and is for sale by Messrs. Bachrach Bros., of Baltimore, Md. Celloidin is a pure pyroxline, free from all organic constituents, and makes a clear solution, free from all sediment, when dissolved in equal parts of 95 per cent. alcohol and sulphuric ether. By this

method all fragile specimens containing the products of inflammation may easily be cut without losing the contents of the vessels into which the inflammatory exudate has taken place. The specimen is hardened in alcohol as above described, but is allowed to remain forty-eight hours in absolute alcohol, from which it is taken and placed in sulphuric ether for two days. From the ether it is placed in a thin solution of celloidin, for the purpose of soaking it through and through—seven to ten days is sufficient to accomplish this end.

The specimens are imbedded in paper boxes in the usual manner, or as I do, imbed, and at the same time fastening them to the cork. I wrap a cork with heavy writing-paper, and allow it to project an inch beyond the cork; the cork forms the bottom of the box. Pour upon the cork a thin film of the imbedding solution, and allow it to dry. Moisten this film with a drop of ether, adjust the specimen, add a little more of the celloidin solution, and allow it to become semi-solid, thus fixing specimen. Then fill the box with a thicker solution, wholly covering the specimen, let stand in the air until semi-solid, remove paper and extra celloidin with a knife, and place in a solution of 80 per cent. alcohol for twelve hours, when the specimen will be ready for cutting. Specimens when prepared in this way may, when cut, be stained in the different staining fluids. Care should be taken when clearing them not to use oil of cloves or absolute alcohol, for both dissolve the celloidin. Use alcohol of 95 per cent. and oil of origanum or oil of sanders. Where the former oil is used let the specimen remain from two to four days.

Celloidin comes in two forms—in plates and in shreds; the latter is to be preferred, as it if more easily dissolved. The solution should be kept in a glass-stoppered bottle.

The microtome which I use is one manufactured in Leipzig, Germany, and is known as the Schanze Microtome. It cuts hardened specimens; and fresh specimens may be frozen and cut as easily as those hardened in alcohol. It has been widely used upon the continent, and in all laboratories it has given perfect satisfaction. It works rapidly and does its work well; it must be seen to be appreciated. Specimens may be cut as thin as $\frac{1}{2500}$ of an inch, and to the size of a half dollar in diam-

eter. In cutting the knife is kept flooded with alcohol to prevent tearing the specimen. The specimens are taken from the knife by means of a camel's-hair pencil, and are dropped into a vessel of water.

To color the sections, they are taken from the first dish and washed in pure water; the excess of water is absorbed by touching the specimens to a piece of blotting-paper; this is done so as not to dilute the staining-fluid. I prefer picro-carmine or alum-carmine and hæmatoxylin in the staining of animal tissues. From the staining fluids the specimens are placed in water containing acetic acid, and allowed to remain a few moments. They are then washed until no more color is given off, when they are transferred to alcohol of 96 per cent., where they remain for ten minutes, and are then submerged in oil of cloves for five or ten minutes.

To place the specimen upon the slide, I first float it upon a piece of paraffined paper (a trifle larger than the specimen) with the aid of a fine camel's-hair pencil. If there are wrinkles in the specimen I hold the paper and the edge of the specimen with the forceps and dip again and again into the oil of cloves until the wrinkles have disappeared. Transferring the specimen to the slide, place it face downwards upon the center of the slide, and gently place a blotter upon the paraffined paper covering the specimen; this is to absorb the excess of oil. Carefully remove the paper with the forceps, and wipe the slide with a clean linen cloth, being careful not to disturb the specimen. Add a drop of Canada balsam, thinned with chloroform, and place the cover-glass in position. Do not press out the air-bubbles, they will disappear after the first twenty-four hours. Pressure upon the cover-glass often causes the specimen to break or become disarranged.

These methods, as above described, I have found to work well, and if others will follow them there is no reason why they will not succeed in their hands.

ORIGINAL METHOD OF STAINING AND MOUNTING POLLENS.

BY REV. J. T. BROWNELL, A. M., AUBURN, N. Y.

1. *Material used.*—Canada balsam, spirits of turpentine, alcohol, analine colors, dissolved in alcohol.

2. *Operation.*—Place a blank slide on the turn-table; apply a small drop of the staining fluid to the center of the slide and place in it the requisite amount of pollen, and spread it evenly on the glass by placing the sharp point of a teaser in the center of the mass and drawing it gently to one side while the slide is rapidly revolving; washing away the superfluous stain by dropping clean alcohol on the mass of pollen, using for this purpose a sharp-pointed teaser; wipe away the out-flowing fluid by the use of a small piece of clean cloth rolled neatly and applied to the outer edge of the waste fluid, gradually moving it inward, as the slide revolves, until only a small circle is left covered with pollen; allow a few moments for the alcohol to thoroughly evaporate from this; then apply a minute drop of spirits of turpentine, so that the balsam may permeate the mass without enclosing air-bubbles; next apply the balsam, *dropping it in a ring around the pollen*, and moving it up to the center by placing a small chisel, held upright, to the surface of the slide, at an angle such as to gather it, the balsam, together as the slide revolves; now lay on the cover-glass and settle it well to place, applying pressure (with a tremulous motion of the hand) sufficient to bring all the pollen grains to a common plane, but yet so as to avoid crushing them; remove the superfluous balsam, using the small chisel as before, only setting it so as to throw the balsam away from the cover into an outer ring—which operation serves also to accurately center the cover-glass; and, lastly, using a wider chisel, take up this ring of balsam, and the slide, furnished with a temporary label, is laid away to cure.

3. *Practical suggestions.*

1st—To secure pollen perfectly clean, the blossom should be plucked just before the unfolding of the flower, placed in a suitable vase with water, and left to expand under bell-glass cover.

2d—To preserve pollen for future use, tease it out into a watch-glass and leave it for some days, under cover; then store it in small vials properly labeled. Some pollens, however, as the Malvaceæ, will not keep in this way; preserve such in alcohol, taking care to provide the vials with rubber stoppers to prevent evaporation.

3d—To avoid *mixing* pollens: Have all the implements in use clean to begin with; work at but one kind of pollen at a sitting; have no draft of air across the table while at work; when through with the job on hand thoroughly wipe the utensils, including the turn-table and work-table; then wash the hands and brush the clothes *outside the room.*

4th—The *teasers* used in the staining process are readily made of common sewing needles, large size, and set in the cork of the vial so as to reach a half-inch, or more, into the fluid; the point should be broken off and then ground smooth so that the fluid may be applied to the slide by a mere touch of the end of the teaser.

5th—*Chisels* for the use named, and far superior to anything found in the market, any one can readily make for his own use. For the narrow chisel set a *crooked awl*, large size in a suitable handle; break off about one-half the length of the curve and grind the face of the chisel on the convex side with the *bevel* on the other; cost one cent. For the wider chisel take a piece of *clock-spring* four inches long and three eighths of an inch wide; straighten it nicely and set it in a handle, then grind to chisel edge, and keep *sharp.* For this your jeweler will probably charge nothing; that is, for the piece of spring.

6th—All utensils should be furnished with handles, made of any handy light wood (the lighter the better) and so constructed that when laid down they will neither roll about nor tip so as to allow the points to touch the table.

7th—All that has been said above applies equally to the mounting of *smuts*, save that these, being dark in color, do not need to be *stained*, which is also true of *many pollens.*

HOW TO MAKE WAX CELLS NEAT, PERMANENT AND FREE FROM "SWEATING."

BY REV. J. T. BROWNELL, A. M., AUBURN, N. Y.

Use the sheet wax, found at places where artists' materials are kept for sale. Procure an assortment of the brightest colors, including also a package of white. Take a sheet of each and mark it off into $\frac{3}{8}$ inch squares, using ruler and penknife point. Break off a square of the white, lay it on the center of

a glass slip, and press it firmly to place, taking care, however, not to *crush* the wax. The warmth of the hands will ordinarily supply all the heat required. On this lay other squares of wax, using colors according to fancy, until a sufficient depth is reached for the cell required. Place the slip on the turn-table, and, with a small, sharp chisel, "turn out" the center, forming a cavity in size determined by the object to be accommodated, but leaving the bottom or white layer of wax undisturbed. Next "turn" off the outer portions of wax until you have a ring of the diameter desired. By a deft use of the chisel various patterns of mouldings and shades of colors may be wrought into the cell, giving it a very attractive appearance. Cover the whole with a thin coating of shellac varnish (shellac bleached dissolved in alcohol), leaving uncovered, however, enough of the bottom of the cell to receive and *hold* the object. The cell will soon *cure*, when it is ready for use. In fastening on the cover-glass use the shellac varnish. As a final finish there is nothing superior to a balsam wash—diluted balsam used as a varnish.

A *chisel* for the uses named, and far superior to anything found in market, may easily be made by any one, as follows: Procure a crooked shoe-awl, largest size; break off two-thirds of the bent portion; grind to a chisel-edge, having the *bevel* on the inner side of the curve, set in light, home-made handles. Cost of improvement, one cent.

A CHEAP AND EFFICIENT LIFE-BOX.

BY JAMES E. WHITNEY, ROCHESTER, N. Y.

It is often very desirable to use several life-boxes in the comparative examination of different "finds," but their expense has heretofore limited most observers to the use of one or two. The advantage of having quite an assortment of various sized boxes is apparent.

The writer has devised the following simple but efficient form of life-box, which is easily made and almost without expense—the entire cost per box not exceeding five cents.

Get from any hardware store a full set of brass ferrules,

consisting of about a dozen ferrules of graduated sizes, fitting snugly one inside the other. Take any two which fit well together and cement the smaller one, large end down, to the center of an ordinary glass slide. Cement to the top of the ferrule one of the thickest cover-glasses you have that fits it. Now take another cover-glass which fits *inside* the larger ferrule, and cement it to the inside at the top. The box is now complete, and all that remains to be done is to slip the larger ferrule over the other. Mica can be used instead of the cover-glasses, if desired.

CHEAP PUNCHES FOR SHEET WAX.

BY JAMES E. WHITNEY, ROCHESTER, N. Y.

As wax remains one of the best materials for building up the walls of cells, it may be of interest to describe a plan by which any worker can make for himself a series of punches ranging in size from one-fourth inch up to one inch, at an entire expense of about ten cents for the set of a dozen punches.

Get a set of brass ferrules, such as described in the account of the life-box, and with a round file bevel the large end to a cutting edge, which is easily done, and you will then have a set of punches of convenient size adapted to making wax rings of sizes corresponding to all the ordinary sizes of cover-glasses.

PRACTICAL QUESTIONS, ANSWERS AND SUGGESTIONS.

1. What is the best method of imbedding leaves and plant stems in the well of the microtome?

A. L. WOODWARD, Syracuse.

I have not had the *best success* by the use of any "medium" which I have attempted, nor in the use of a microtome with a well.

I use soft cork or the pith of cornstalk or elder, or any other material that will yield to the pressure of the stem or leaf; shaping the materials as nearly as may be to the form of the stem or leaf to be cut.

Vegetable stems or leaves should be cut immediately after they are broken from the plant. To imbed them they must be more or less dried out. In drying they shrink; shrinking compresses the stem,

which of course distorts its internal structure, and the sections will not show the true structure.

Rivet's pattern of microtome is the most convenient I have seen for cutting such material.

WM. HUMPHREY, Adrian, Mich.

2. Is there any definite rule for adjustment of cover-correction of objectives?

There is no *one* rule which can be *easily* made to work with all objects.

Correcting by coma is the one which is most generally to be relied upon. With diatoms the apparent position of the marking serves as a guide. Correction color is frequently made when the object is transparent and well marked.

A. Y. MOORE, Cleveland, O.

3. How can one best provide for preserving the life of a species while studying its life history?

That depends certainly upon the object. Some objects keep well in the animalcule slide of Prof. Weber. Others need a continuous supply of fresh water. For large objects Holman's Siphon-Slide is good. There are many "Life" slides which are good, but a difficulty is generally found in keeping *any* object alive any length of time.

A. Y. MOORE, Cleveland, O.

4. What objectives will constitute the best working series for practical use with $\frac{1}{2}$-inch, 1-inch and 2-inch eye-pieces?

My own experience would lead me to prefer a $\frac{1}{2}$-inch and $\frac{1}{6}$-inch. The aperture in each case to be the greatest consistent with *the best* chromatic and spherical corrections.

If four objectives be allowed I should recommend a 1-inch, $\frac{1}{2}$-inch, $\frac{1}{4}$-inch or $\frac{1}{8}$ of 100° to 150° (air) and $\frac{1}{10}$. The last to be homogeneous immersion and wide angle.

A. Y. MOORE, Cleveland, O.

5. Where shall we commence to measure to obtain what is called the standard length of a microscope tube?

I am unable to state with certainty, at present, but think from an investigation of objectives that I am now making that it differs in different objectives according to formula of construction, etc.

A. Y. MOORE, Cleveland, O.

6. What is the best microtome for cutting vegetable sections, such as woods, barks, roots, etc.?

I do not undertake to say which is the best. For wood I use a carpenter's vise and a very finely set carpenter's smoothing-plane. Then select from the shavings for sections. Same for barks and hard roots. WM. HUMPHREY, Adrian, Mich.

Boil the wood until soft, then fasten in microtome well and cut with a sharp chisel. B. F. QUIMBY, Chicago, Ill.

7. What is the best method of sharpening the knife for cutting vegetable sections?

A. L. WOODWARD.

I use a fine hone, finishing on a razor strap, holding the knife close to hone so that the back touches. The knife needs sharpening oftener when used for vegetable sections than when cutting animal tissues, because of the presence in vegetables of a great abundance of crystals.

WM. HUMPHREY, Adrian, Mich.

8. What is the best cement for sealing preparations that are to be used with homogeneous immersion objectives?

I use nothing but the white zinc cement, furnished by Mr. Walmsley, of Philadelphia.

J. EDWARDS SMITH, M. D., Cleveland, O.

Depends entirely upon the fluid to be used. If oil, such as cedar oil—*shellac* is good. If the glycerine fluids, almost *any* cement answers well. A thin solution of gelatin is good with oils, for alcohol or chloroform can be used to clean off with.

A. Y. MOORE, Cleveland, O.

10. What is the best method of adjusting an adjustable objective to produce the most satisfactory image? Has the plan of Zeiss (the plan is at least stated by him) any objectionable features? As I understand his plan it is to mark various thicknesses of covers on his adjustable objectives, then the thickness of a cover being known, the best adjustment is obtained simply by turning the adjusting collar till its index is opposite the number indicating or corresponding to the thickness of the given cover-glass.

There is no royal road to the adjustment of objectives; the art can only be acquired by patient practice. The above-named method of Zeiss—as also the plan proposed by A. Ross—in fact, any mechanical method, all are faulty and unsatisfactory in practice. *Examples given:* Suppose we have in hand a balsam diatom slide, having $\frac{1}{300}$-inch cover; then those diatoms in contact with the under side of cover will require

a different adjustment of objective from those in contact with the top surface of *slide*. Furthermore, owing to *varying* conditions of the eye, an expert manipulator working this slide *at different dates* would fail to use the same adjustment of the objective.

J. EDWARDS SMITH, M. D., Cleveland, O.

11. What is the best method for breaking down Barbadoes earth before boiling?

G.

A saturated solution of citric acid which acts on the iron more promptly than the mineral acids.

F. S. NEWCOMER, M. D., Indianapolis, Ind.

12. What is the best size for holding diatoms in arranged slides?

Febiger's size, as follows: Acetic acid, 12 drachms; photographer's gelatin, 2 drachms; alcohol, 1 drachm.

Use a porcelain dish; add acid to gelatin, and stir in a water bath until dissolved; then add the alcohol and filter. Spread on slide with fine needle.

F. S. NEWCOMER, M. D., Indianapolis, Ind.

13. What is the best bleacher for diatoms to be used when boiling?

Deflagrate with potassium nitrate (saltpetre) in small quantities at a time. Sulphate of potassium and pure diatoms will be left. The sulphate can easily be washed away with water.

F. S. NEWCOMER, M. D., Indianapolis, Ind.

14. What is the best method of eliminating flocculent matter from diatoms after boiling?

For large forms boil in pure soap; let diatoms settle and pour off soap and water. For small forms I prefer aqua ammonia.

F. S. NEWCOMER, M. D., Indianapolis, Ind.

15. What is the best bristle for picking diatoms?

I prefer a cat's whisker.

16. What diatomaceous material is most easily cleaned, and where found?

Of fossil earths, perhaps Cherry Hill, Me., or electro-silicon, a polishing powder found at the stores. Prof. H. C. Smith's method of boiling in soap and water is all that is needed. X.

17. How make colored varnishes for finishing purposes?

Good finishing varnishes are made by adding dry colors to dammar varnish or balsam, grinding and filtering. Allen Y. Moore makes a beautiful black of asphalt and of Japan gold-size.

E. H. GRIFFITH, Fairport, N. Y.

18. What will make a dead black back-ground for slides?

Use the finest and the best ivory-drop black, such as is used by carriage-painters. Mix with turpentine. X.

19. Is an instrument practicable of moderate *weight* which shall carry *all* really valuable accessories (supra and substage), so adapted as to be always ready for immediate use, expenses not regarded?

P. L. HATCH, Minneapolis, Minn.

Yes. E. H. GRIFFITH, Fairport, N. Y.

20. What are some of the most interesting microscopic crystals?

The chemical crystals I have found most interesting, and many of which I have prepared, viz.: Salicin, santonin, helicin, asparagin, aspartic acid, bicromate of potash, arsenious acid, cinchonoidin, hippuric acid, oxalate of ammonia, quinidin, sulphate of cadmium, sulphate of copper, chloride of copper, platinocynide of magnesium, pyrogallic acid. [All the above selections from the Proceedings of the American Society.]

ONE RESULT OF DR. DALLINGER'S VISIT.—Dr. Anthony said that it gave him great pleasure, after hearing the account which the President had given them, to propose on behalf of the Society that its warmest thanks be given to the American Society of Microscopists for the very cordial, generous, and hospitable reception which they had given to the representatives of the Society on the occasion of their recent visit to the annual meeting at Rochester. He had himself fully expected that a deputation from this Society would meet with a hearty welcome, and he was sure that all would be glad to hear how thoroughly these anticipations had been realized. It had not unnaturally been regarded as an evidence of very friendly feeling that a Society like theirs should send its representatives to express an interest in what was being done across the water; long might it be the case that the people who formed that great nation would remember with affection the old country from which they sprang.—*Royal Mic. Journal.*

VIEWS ON THE CHOLERA BACILLUS.

Later reports of the work of Drs. Klein and Gibbes (the English cholera commission) in India justify their conclusions more than what we had seen when speaking of it last week. Their results are summed up in the *Gazette of India* for Nov. 28, 1884 (*Lancet*, Jan. 5, 1885), and are as follows: 1°. They find 'comma bacilli,' so called, in other diseases than cholera, as epidemic diarrhœa, dysentery, and intestinal catarrh, associated with phthisis. 2°. They did not find the comma bacilli in typical cases of cholera in anything like the numbers claimed by Koch: they never approached the appearance of a 'pure culture' in the ileum. 3°. They did not find the comma bacilli in the tissues of the intestines, or elsewhere, as Koch did. 4°. Klein was unable to discover that the comma bacilli differed from any other putrefactive organism under cultivation. 5°. They found peculiar-shaped bacilli, very small and straight, in the mucous-corpuscles found in the mucus-flakes removed from the intestine soon after death from cholera: they found these same bacilli always, even when the comma bacilli were not discovered. 6°. These bacilli do not behave in any peculiar way under cultivation and are not to be found in the tissues of the intestines, or elsewhere. 7°. They did not find any bacteria of any kind in the blood, or in any other tissue. 8°. Many experiments gave the following results: (*a*) Mice, rats, cats and monkeys were fed with rice-water stools, with vomitus, with mucus-flakes from the ileum, both fresh and after having been kept for twenty-four hours (the animals remained in good health); (*b*) Inoculations with recent and old cultures of the comma bacillus, and of the small straight bacillus, as well as with mucus-flakes, were made into the subcutaneous tissue, into the peritoneal cavity of the small and large intestine of rabbits, cats, and monkeys; but the animals remained perfectly well and normal.—*Science, from the Lancet for January.*

PROF. E. RAY LANKESTER does not hesitate to say: (1) that Koch's comma bacillus is *not* comma-shaped; (2) that it is *not* a bacillus but a spirillum; that although it does sometimes (but not always) occur abundantly in the intestines of cholera patients, there is not a tittle of evidence to show that it causes

cholera, no experimental attempt to produce cholera by its agency having succeeded. These conclusions are derived from Dr. Koch's own statements. While Dr. Koch is, as was to be expected, perfectly candid and convincing in the account which he gives of his observations, the extraordinary feature in his report is the dogmatic declaration that this organism, which is not in any way proved to possess disease-producing powers, nevertheless must and shall be henceforth regarded as the cause of cholera. Dr. T. Lewis, who for many years studied microscopically the intestines and evacuations of cholera patients in Calcutta, has demonstrated, since the publication of Koch's report, that the so-called comma-shaped bacillus is identical in form with one occurring commonly in the mouths of healthy persons."—*Royal Microscopical Journal.*

ZINC CEMENT AGAIN.

BY FRANK L. JAMES, PH. D., M. D.

In the November number of the *American Monthly Microscopical Journal* the editor once more proceeds to demolish zinc cement as a material for cell building and mounting. After calling attention to the letter of a correspondent who complains of the cement, and repeating his statements as to the utter unfitness of zinc for the purpose for which it has been used and for which I strongly recommend it, the doctor thus refers to my former remarks on the subject:

"We refer to the subject at length because of its importance to every mounter, but we are especially led to bring it prominently forward again because a certain writer in St. Louis has recently recommended its use. Now, it is impossible for us to believe that the author in question was not aware of what we had said concerning the cement, yet he deliberately tells his readers to use it without so much as a hint that it had been declared unreliable."

Here's richness for you, and modesty, too! Right you are, my dear doctor, in your belief that I was aware that you had "declared zinc cement unreliable," but I did not consider your opinion of sufficient weight to counterbalance my experience with the material—extending, as it does, over a period of nearly

or quite fifteen years. I stated, in my various articles, that objections had been made to the cement by various microscopists, and some of them men of prominence, but I also stated what I again reiterate, that, in every instance where zinc cement disappoints its user, it is because the article is improperly made, or improperly used, or both. The learned doctor's habit of impunging tbe motives and cheapening the work of others is too well known to make any answer to the balance of his article necessary. To the motto of the ancient Pharisee, "I am more righteous than thou," he seems to have also added, "I am more skillful than thou," and hangs his banner on the outward wall on every occasion, where it henceforth may float—for all that I care.—*Nat. Druggist.*

THE MICROSCOPE continues as bright and newsy as ever, and, for one dollar a year, is the cheapest periodical of the kind extant. Ann Arbor is its home.—*Odontographic Journal.*

DR. L. YOUNGHUSBAND, of Detroit, has just received a letter from Prof. Koch, of Berlin, with a microscopic slide of the "Comma-bacillus," which is regarded by Dr. Koch and his followers as the sole cause of cholera.

ERROR IN PHOTOGRAPHING BLOOD-CORPUSCLES.—A note on a possible source of error in photographing blood-corpuscles, by G. St. Clair, communicated to the Birmingham Philosophical Society, is a fruitless attempt to explain as an optical illusion Dr. Norris's asserted discovery by the aid of photography of a third kind of corpuscle in mammalian blood. The author invokes the principle of the formation of images by the passage of light through small apertures, and conceives that Dr. Norris's "colorless disks" are merely images at the end of the microscope-tube or the aperture of the eye-piece, and he seems to have taken some pains to obtain such images by placing under the microscope a slide thickly strewn with small steel disks, and receiving the light on a screen beyond the eye-piece. Had he attempted to focus these ghosts and the real images of the disks *at the same time*, or considered a little more closely the elementary optical principles involved, we venture to say they would never have been written.—*Royal Mic. Journal.*

DR. KOCH ON THE CHOLERA-BACILLUS.—The cholera bacillus is not quite straight, like most other bacilli, but is somewhat curved, in the manner of a comma, or even nearly semi-circular. In cultivation there often arises S-shaped figures, and shorter or longer slightly wavy lines. They are endowed with active spontaneous motion. They can be best observed in a a drop of nutrient fluid attached to the cover-glass, which they are seen to swim through in all directions. In gelatine they form colorless colonies, which are at first close and have the appearance of small fragments of glass, but gradually spread through the nutrient fluid. They have a tendency to collect at the margin of the drop, where their peculiar movements can be well-observed, and their comma-like form after treatment with anilin-solution.

As to the question whether their presence is simply due to the presence of the choleraic disease which promotes their growth and development, or whether they are themselves the cause of cholera, Dr. Koch is very strongly of opinion that the latter is the true explanation, since they are never found either in the organs or the ejecta, except in the case of patients who have either died of or are suffering from cholera. They are also found only in that organ which is the seat of the disease, viz., the intestines. In the first feculent ejecta, the bacilli occur only in small quantities; while in the later liquid odorless ejecta, they occur in enormous quantities, all other kinds of bacteria being almost entirely absent; they diminish in number as the excreta become more feculent, and have entirely disappeared when the patient is completely restored to health. Their abundance appears to correspond to the degree of inflammation of the mucous membrane of the intestine, attaining their maximum when this is of a bright-red color, and the contents a colorless odorless fluid. When the contents become offensive from effusion of blood the bacilli decrease in number and are found only in the vesicular glands and their neigborhood. Where death results from a secondary complaint following cholera, they are altogether wanting. Their behavior therefore closely resembles that of all other pathogenous bacteria, their development being proportional to the severity of the disease.—*Roy. Mic. Journal.*

A FRENCH CRITICISM ON KOCK'S CHOLERA-BACILLUS.—At the meeting of the Académie de Médicine, August 5, a report was read by M. Strauss for himself and M. Rough, containing a summary of the labors of the French Commission in Egypt and in Toulon. It declared that the disease in France was identical in its morbid anatomy with that in Egypt. With regard to the supposed specific organism giving rise to cholera, it stated that in the intestinal mucous membrane there were found a variety of forms of bacteria, especially when the case was prolonged; but in the very rapid cases these organisms are much less numerous, and in the most acute *it is impossible to detect their presence.* Following the method of Weigert, adopted by Koch, the Commission declared that "in a goodly number of cases of cholera the micro-organisms cannot be found in the intestinal tunics." The comma-bacillus which Geheimrath Koch considered as being the cause of cholera was also recognized by Messieurs Strauss and Roux, though it was not constant, and was generally less numerous than other micro-organisms. Conceding to these bacilli *en virgule* an important *role* in cholera, at the same time they claim that other organisms are equally present, and sometimes in numbers so large that neither seems to preponderate. It is also claimed that these organisms are not peculiar to cholera, but have been met with in dysentery, as reported by Malassez. In leucorrhœa, and in the discharge from a case of uterine epithelioma, M. Strauss had also found microbes similar to those mentioned. The reporters conclude with the statement that if the comma-bacillus be the true cause of cholera it inhabits only the intestinal contents, and in the most rapid cases it does not invade to any appreciable extent, the mucous membrane. It is neces, sary, then, to admit that, in order to produce effects so rapid and so intense, it acts by secreting a soluble ferment, a ptomaïne, or a poison of some kind, which, being absorbed, provokes the symptoms of cholera. It is of interest that pure cultures should be made and examined for such poison; it would also be important to ascertain if the comma-bacillus occurs in cholera nostras. The peculiar and extremely minute particles found in the blood of cholera patients in Egypt by the French Commission were also detected in the blood of patients at Toulon; they were attributed to a special alteration of the hæmoglobin.—*Le Progrès Médical.*

REVIEWS.

ORCHIDS, THE ROYAL FAMILY OF PLANTS. With 24 Illustrations from Nature, by Harriet Stewart Miner, in colors, each 10 by 14 inches. With descriptive letter-press. Bound in gold, silver, or bronze cloth, full gilt edges, price $15.00; Turkey morocco, or tree calf, $30.00. Lee & Shepard, Boston.

It would be difficult to find many persons who know anything about Botany who are not always interested in this "Royal Family of Plants." Their beauty, their curious shapes and their peculiar life-history make them "the elite of the Floral Kingdom."

The illustrations were drawn from specimens found in American collections; and the coloring represents the natural beauty of the plants.

The binding of the copy before us is of the heaviest Turkey morocco, and with the text forms a model of workmanship. We have never seen more beautiful plates. The whole work is the most magnificent of its class we have ever seen, and many reviewers have declared it "the most beautiful and superb work ever issued in this country."

THE ORCHIDS OF NEW ENGLAND. A popular monograph. By Henry Baldwin. 8°. pp. 160. Ill. 40. 1884. John Wiley & Sons. $2.00.

It is not every lover of nature that can see their way clear to indulge in such a magnificent work as the one noticed above. To all such we commend the work by Mr. Baldwin. It treats of the Orchids of New England, where are forty-seven species. The author gives the leading characteristics of the Orchis family; how to identify each species; and he illustrates many of them with full-page, well-executed wood-cuts. Botanists and floriculturists will rejoice to hear that they have a work like this at their command; they need have no longer simply a bowing acquaintance with this rural family.

A MANUAL OF ORGANIC MATERIA MEDICA. By John M. Maisch, Phar. D., Professor of Materia Medica in the Philadelphia College of Pharmacy. Second Edition. pp. 511. Ill. 242. 1885. Lea Brothers & Co., Philadelphia.

The first edition of this work came to our review table three years ago, and for over a year has been out of print. This edi-

tion has been greatly enlarged, and embodies several novel features. Among the latter may be mentioned a description of the most important drugs indigenous to North America, and also a list of remedies classified according to their zoological or botanical derivation. The work gives the essential physical, histological and chemical characters of the organic drugs, thus rendering the work also a useful and reliable guide in business transactions. It embraces all the drugs recognized by the U. S. and British Pharmacopœias, together with important old drugs, now unofficinal. The microscopical characteristics are unusually full. The work will have a large and ready sale.

THE ELEMENTS OF PHYSIOLOGICAL PHYSICS. By J. McGregor-Robertson, Demonstrator of Physiology in the University of Glasgow. 12°. pp. 528. Ill. 219. Henry C. Lea's Son & Co. 1884. For sale by Osius & Co., Ann Arbor, Mich. Price, $1.50.

This is one of the "Manuals for Students of Medicine" as issued by the well known Philadelphia firm. The work embraces the elementary facts and principles of physics with their physiological applications. There is also some detailed description of physical apparatus and methods as adapted to physiological purposes. The book is one calculated to enable the student to take it to the laboratory and, with its aid, set up and work out the experiments for himself.

COMPARATIVE PHYSIOLOGY AND PSYCHOLOGY. By S. V. Clevenger, M. D. Chicago: Jansen, McClurg & Co. 8°. pp. 250. Price, $2.00. 1885.

In this interesting little volume we have a discussion of the evolution and relations of the mind and body of man and animals. The author grapples the question of the physio-chemical basis of psychological phenomena with great force and tact. The intention of the work appears to be to elaborate a mental science which will reconcile the observations of anatomists, psychologists and pathologists with direct reference to the more intelligent treatment of insanity. We fear that Dr. Clevenger will be misunderstood by some statements made in the second chapter concerning spontaneous generation; perhaps, however, he believes in it. For us, we simply believe with Dr. Dallinger that there cannot be found a scientist of to-day who accepts the doctrine.

In the closing chapters there is a special consideration of the various faculties of the mind, which are most critically interpreted and analyzed. One finds himself amazed, as he reads page after page, at the wealth of information and amount of labor found between its covers. It will be perused with rare interest.

MOREL'S MANUAL OF HISTOLOGY :
QUECKETT'S LECTURES ON HISTOLOGY. Two Volumes.

The above volumes have been added to our private library by the gift of Professor Ford, of this city. For over thirty years Prof. Ford has been engaged in teaching Anatomy in the Medical Department of this University. During a large portion of that time he has also taught Physiology, and was one of the first in this country to embody in his lectures the minute structures of the tissues. Before becoming connected with the University he imported a microscope at the early date when such an instrument was a constant wonder and surprise. The first great task he had to overcome was *to put the instrument together.* None of his associates or acquaintances could offer any aid, and thus what he accomplished was truly a result of his own personal effort. The "Histological Laboratory" is a direct outgrowth of efforts made by him early and late; and it is one of the ambitions of the director of that laboratory to-day to make it after the ideal of its founder and earnest friend.

THE MODUS OPERANDI OF THE CELL FORMATION OF ANIMAL AND VEGETABLE LIFE. By Eliza A. Burnham. Grand Rapids, Mich. 16°. pp. 150. Price, 50 cents. 1879.

OUTLINE OF VEGETABLE HISTOLOGY. By Mrs. Wm. Streeter, Rochester, N. Y. pp. 11. Plates V. Price, 50 cents.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

WILL exchange mounted slides of various minerals (native crystals), and others, for well mounted slides. WILL H. OLMSTED, Syracuse, N. Y.

EXCHANGE.—Parties having diatomaeeous earths or other microscopical material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow. Msss.

SEVERAL Photographic Instruments, list of photo California Views, on paper 5x8, or stereo, or same on glass for magic lantern; upwards of 100 oil, four-inch paintings of foreign scenes, for lantern; to exchange for good microscope stand and accessories, slides, etc.
R. E. WOOD, St. Helena, Napa Co., California.

WOULD like to exehange a 1-6 Objective, 168°, adjustable, for a lower power.
A. Y. MOORE, 89 Prospect St., Cleveland, Ohio.

QUEEN'S New Sub-Stage Condenser, with dividing eombination for high or low powers, and three Caps, for sale or exehange. DR. A. C. STOKES, Trenton, N. J.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

WANTED—To exchange, an $85.00 Caligraph, almost new, or an Anthony's Amateur Camera, for a new or second-hand Microscope. W. C. GORMAN, Randolph, New York.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FRESH-WATER ALGÆ, nearly all genera, and many beautiful varieties; also Euglena, Astasia, etc., for good pathological or other interesting slides. Lists exchanged.
J. M. ADAMS, Watertown, N. Y.

WOULD like to exchange a 1-6 Bausch & Lomb patent adjustment (glycerine front) objective, almost new, for a 1-4 of moderate angle. C. B. HIGBY, Mokelumne Hill, Cal. Co., California.

WANTED—Diatoms on Algæ, from the Sandwich Islands, California coast, and other tropical sea coasts. Will give in exchange either very good mounted micro-slides or cash, for good material. J. C. PRINNBOCH, 14 Simmering, Wien, Austria.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
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HISTOLOGICAL mounts to exchange for other good slides.
T. B. STOWELL, Ph.D., Cortland, N.Y.

HISTOLOGICAL SLIDES, very thin and evenly cut, well mounted and well ringed, will be exchanged for Pathological or Histological slides only.
H. L. WHITNEY, M.D., German Hospital, Philadelphia, Pa.

WALMSLEY'S Photo-Micrographic Camera and Plate-Holder, together with the Chemical and Printing Outfits, and a Darlot's Focusing Glass, for sale. Also, Sidle's Iris Diaphragm, with society screw for sub-stage; Beck's 1 in. and ½ in. Objectives (National); Bausch & Lomb's 2 in. Objective. F. J. SCHAUFELBERGER, M.D., Fostoria, Ohio.

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FOR SALE or exchange, a Taylor Freezing Microtome.
F. O. JACOBS, Newark, Ohio.

FOR SALE. CHEAP—A Bausch & Lomb Dissecting and Compound Microscope (as figured in their Catalogue, p. 6); has a Wales dividing objective ½ to ⅔, two simple lenses 1½, hand rests, eye shade, etc. GEO. TIMMIN, Syracuse, N. Y.

WILL GIVE a good bargain in micro-objectives, new, made in 1884, for a Morrison *wide angle* view lens, for 5x8 or 6½x8½ photo-plates. Write for particulars.
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WANTED—A good Zentmayer Stand. Second-hand Bi- or Monocular cheap, for cash. Address M. KAISER, 424 Sycamore St., Buffalo, N. Y.

W. R. MANDEVILLE, M.D., of New Orleans, La., 483 Magazine St., has for exchange or sale a number of first-class mounts of Pathological Specimens, including Yellow Fever, Leprosy, and various Bacteria; also a large number of miscellaneous objects.

FOR EXCHANGE—A Gundlach 3 in. 11°: a Gundlach ¾ in. 27°; a Gundlach No. IV. (⅓) 55°; a Geo. Wales 1¼ in. 25°; a Paraboloid, cost $7.50; all in good condition. Wanted, a ½ or 4-10 spy-glass, or good condenser. C. OUDERDONK, Rugby, Tenn.

DIATOMS ON ALGA. Achnanthes bevipes, etc. Polycistana, Fossil Diatoms, etc. Sertularia Pluma, Sertularia Crustata, etc. Spore cases of Fern too numerous to mention, to exchange for well mounted objects. WM. FARNELL, Macon, Ga.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

EXCHANGE.—Untreated diatoms and miscellaneous material in large variety, to exchange for good prepared material for mounting of any kind. M. A. BOOTH, Longmeadow, Mass.

EXCHANGE.—I have about one hundred lantern slides to exchange for microscopical apparatus (object-glasses), etc. W. S. WHITE, 128 and 130 Main St., Kalamazoo, Mich.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

FOR SALE.—Slides, double stained, of Bacillus Tuberculosis, 50c. each.
DR. W. R. CHITTICK, 83 Lafayette Avenue, Detroit, Mich.

WANTED.—Books treating on microscopical and histological subjects not already in my possession. Will pay cash, or give slides in exchange. State name of the work, date of issue, and price. C. H. STOWELL, Ann Arbor, Mich.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

WILL exchange mounted slides of various crystals, diatoms in situ, stellate hairs of plants and micro fungi, for other good slides or material. JAMES E. WHITNEY, Rochester, N.Y.

PATHOLOGICAL, Histological, and other well mounted slides will be exchanged for mounted specimens of interest. Lists furnished on application.
D. E. HAAG, M.D., Liberty Center, Henry County, Ohio.

THE MICROSCOPE.

VOL. V. ANN ARBOR, APRIL, 1885. No. 4.

ORIGINAL COMMUNICATIONS.

HOMOGENEOUS IMMERSION OBJECTIVES.

PROF. A. Y. MOORE.

CONSIDERABLE has been written in regard to the construction of homogeneous immersion objectives with and without the collar adjustment; but I think the views recently expressed by Dr. W. B. Carpenter are about correct. That, in the hands of those familiar with the optical conditions governing the use of the collar adjustment, in objectives so constructed, this adjustment permits of far more correct results than can conveniently be otherwise attained by the use of the same lenses when placed in fixed mountings, there is no doubt in the minds of those who have understandingly used both kinds. It does not happen, however, that all practical workers with objectives constructed upon the principle of homogeneous immersion, are capable of using the collar properly; and it is for this reason that Dr. Carpenter thinks it may well be questioned whether this class of workers had not better accept the correction given the non-adjustable lenses of this kind, by their makers, as indicating the point of their best performance. Undoubtedly, with this class of observers this is correct; for, while the best performance in their hands, owing, perhaps, to conditions differing from those under which it was originally corrected—such as differing tube length or density of the immersion medium—may not reach its maximum performance when used under the proper conditions, still, its average work may be far more nearly perfect than would be the case were adjustable objectives used without paying proper attention to the collar.

On account of the change in the chromatic corrections of

the same objectives when used by central and then by oblique light, Professor Abbe immediately recognized the advisability of using two immersion fluids with the homogeneous immersion objectives, constructed by Zeiss in fixed mountings. The fluid for oblique light was as near as possible, optically homogeneous with the glass of which the front lens was made; while that for central light work, while having a mean refraction to that of the front lens, exceeded it in dispersive power—any slight disturbance of the spherical correction being easily compensated for by a change in the length of the body by the use of the draw-tube. If these conditions be properly attended to, there is but little choice (optically) between the two forms of objectives; but when, as is frequently the case, it becomes necessary to use a fluid having a considerably lower power of mean refraction than the homogeneous fluid, such as water or glycerine, the collar is a great advantage, as the range of action of the draw-tube is not sufficient to produce the negative correction requisite with fluids of such low density.

Many optiicans have made objectives upon the homogeneous immersion principle, of very large aperture and in fixed mountings, which have only been provided with fluid for oblique light. Hence it is, that on account of their large apertures and proper corrections, their oblique, light work has been remarkably fine; but when used with the same fluid by central light, the chromatic under correction has been so great as to injure the definition to a considerable extent.

If the corrections could be easily made, so that there would be no perceptible difference between central and oblique light work, and consequently only one fluid be required, these objectives would be much more convenient for those who, while requiring the best results possible, do not care to be bothered by the constant changing of fluids. That such a condition is possible, in the construction of these objectives, is shown by a new $\frac{1}{8}$ recently produced by the Spencers. The difference in both chromatic and spherical aberrations in this objective for the central and peripheral zones of the lenses, have been reduced to such a small residuum that there is practically no difference—at most not enough to interfere with good definition, as is shown by the lens upon Möller's test plate; in which the

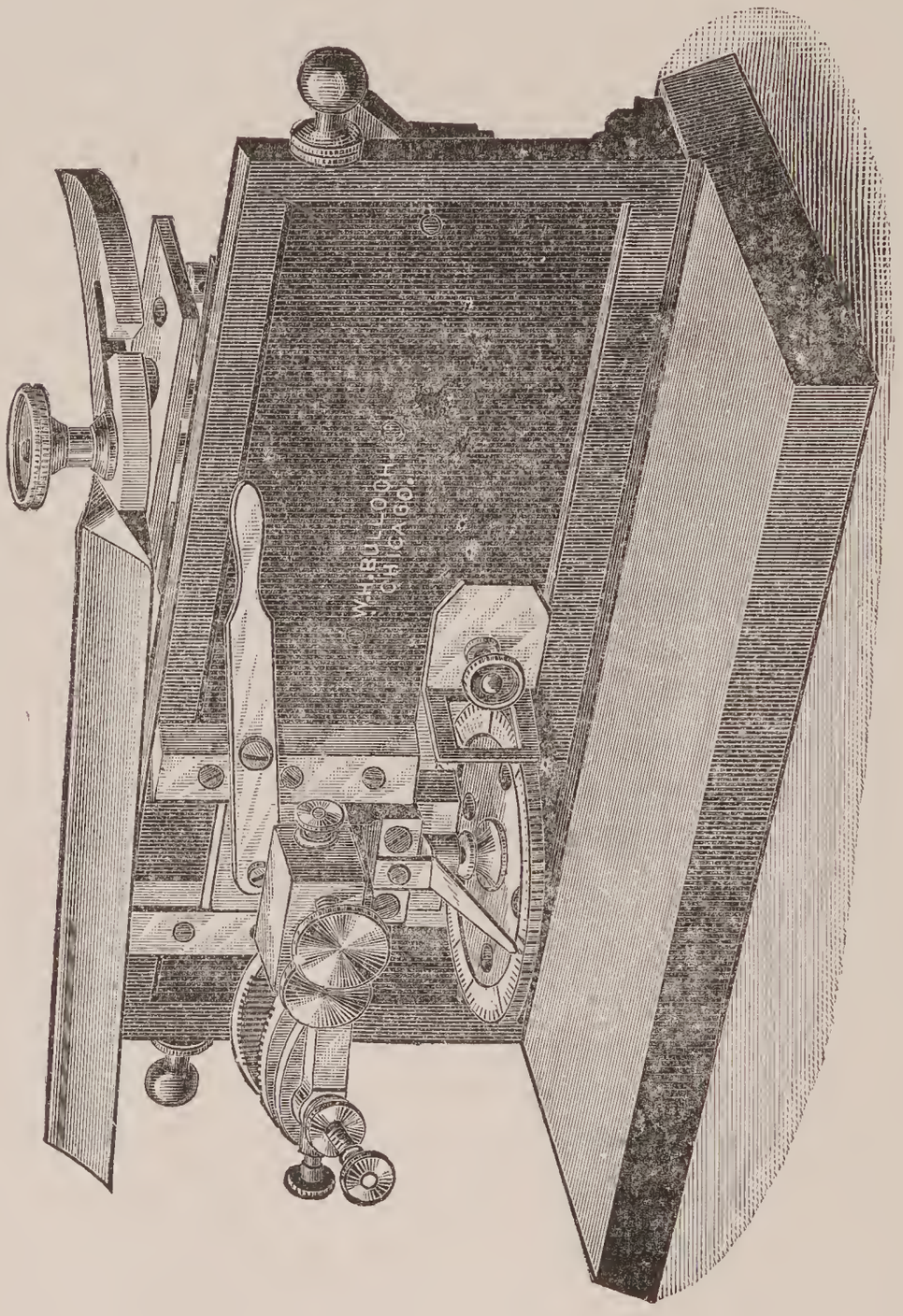
resolution of No. 15 by central and No. 20 by oblique light, with only a slight darkening of the secondary spectrum in the latter condition, furnishes abundant proof. This objective, which is a new one, not yet down on their list, has a balsam angle of 105°, and working distance of a little more than one-thirtieth (correctly, 0.037) of an inch. The single fluid used with it, is one which has been devised by Prof. H. L. Smith, having an index as nearly coincident with that of the front lens as anything yet devised.

Thus, it will readily be seen that by doing away with one of the fluids, and yet not impairing the performance of the objective, its value is greatly increased as a convenient working lens.

BULLOCH'S COMBINATION MICROTOME.

THIS microtome which has lately been constructed by W. H. Bulloch, is a combination of the best points of the German and French with some of his own improvements. The illustration will, to a certain extent, give a general idea of the construction. The main slide for the knife carrier is $10\frac{1}{2}$ inches long, height to cutting edge of knife, $5\frac{1}{2}$ inches. The knife carrier is made with eight ivory bearing surfaces, four on each side, which allows of a smooth and easy running surface, and which does not require to be lubricated, only to be kept clean. At each end of the main slide there is a stop with rubber cushions, to prevent the carrier passing over the end. The upper surface of the knife carrier is made adjustable so the knife can be made to cut at whatever inclination is found best. The knife can also be placed at any angle for cutting or adjusted to cut at right angles for cutting sections in ribbons. Some authorities claim for cutting fibrous tissue or hard sections, a long sliding cut is preferable, whereas for cellular or soft tissue a cut square with the material is best. The screw for elevating the slide and holder is graduated to $\frac{1}{200}$ *mm*, about $\frac{1}{5000}$ of an inch; and with spring click for registering or counting thickness of sections. The spring click can be turned aside when not required. The holder for material has universal motion, so that the specimen can be adjusted to cut at any plane. Each motion is independent of the other; and are so combined that the specimen is not raised

or lowered in adjusting and for the convenience of using the knife square or at right angles to the motion of the knife carrier; and also for cutting sections in ribbons. The holder is reversa-



ble, in which position the specimen is in about the centre of the slide. There is also the German freezing attachment, atomizer and alcohol pan. The base and upright are of iron, japanned. The other parts are of brass, nickle-plated. The case is made so that it is not necessary to remove the instrument, as it unfolds, and will lie flat on the table.

THE WORKING SESSION.

ALBERT MCCALLA, PH. D.

IN a former communication I presented some reasons for regarding the Working Session as a very important part of the meetings of our National Society, and for hoping that it may be given a full and prominent place in the future meetings. It may not be amiss to add some further thoughts in its favor.

First, then, the Working Session is one in which all the members of the Society can meet on common ground. It is true they seem to stand in two distinct classes, experts and learners—but this is only an apparent and temporary distinction. All are together students of microscopic technique, comparing with and communicating to each other the advances they have made, the methods they have tested and those they wish to learn. Workers each in different fields, the subjects of their study are often so diverse that members of such a society sometimes feel but little interest in the results of each others investigations, or only that general interest which they have in all discovery. The diatomist cares but little for the minutiæ of the nerve termini in the lungs; the practical physician, perhaps, votes the carefully written paper on the resolvability of diamond-ruled lines a bore; and the mineralogist gives attention to the botanists discussion of the evolution of the laticiferous tissue of the dandelion chiefly out of courtesy. But each one is deeply interested in the methods of work by which such results were obtained, and is anxious to learn all the latest discoveries in technique, all the niceties of preparation of the objects and manipulation of instruments, that he may turn them to account in his own work. Each microscopist is, or ought to be, able to verify his tools, able to test and calibrate—so to speak—his objectives and other apparatus, to measure accurately their aperture, amplification, and the accuracy of their corrections. Each one wishes to learn the practical details of any promising method of preparation, mounting or examination of objects—and all this can be but learned by actual observation of how acknowledged experts do it.

Again, it should be remembered that while some are so fortunate as to live in large cities and enjoy the benefits of

strong local societies, where all the latest results of the optician's art and the manipulator's skill are soon set forth, a large number, remote from great cities, and from wealthy institutions, can only read of such discoveries. When they meet each other once a year in the sessions of the A. S. M., they wish, therefore, not only to hear papers read and discussed, but to see the preparations described, to examine the slides on which the published statements are based and to study the details of objects and methods they have read of, but never have seen, and so to test their own work by that of others.

But it will be said—and has been said—the Soiree affords opportunity for such work as this, or it can be left to private seances in the intervals of the regular sessions. This is a great mistake. The soiree is chiefly to entain the general public, and has grown to such vast proportions that there is left in it no charm for quiet, careful examination of any special object. The members must each stand guard over their own instrument as a matter of safety for its proper handling, as well as of courtesy to explain the objects shown, so that they have little or no chance themselves of seeing each others exhibits. The special working session for exhibition of methods, and the short sessions for examination of objects referred to in papers, first introduced at the Chicago meeting, are, it seems to me, but a most natural "evolution" of the Soiree of earlier meetings. That became specialized into the Soiree proper, the Working Session, and those special hours for examination. To lump these all together once more, as has been proposed, would be a step in retrogradation, and one which I have little fear the society will ever take. Its tendency would be rather to more complete specialization—the introduction of new features without the sacrifice of old ones. There should be full time for the reading and discussion of papers of general interest—though many should be read only by title, and others in brief abstract only, as has often been done in the past—but at least one-half hour each day should be set apart for the study of preparations referred to in papers, and one-half day should be given for the presentation of methods of work. Visible, tangible demonstration of everything discussed ought to become more and more the rule, and the use of projection lanterns and ordinary and class microscopes to illustrate

statements made in papers or discussions, ought to be far more general than it has ever yet been.

Since writing the above the February issue of this journal has come to hand, and the charming symposium on my connection with the Working Session has been read. I can hardly believe it possible that these gentlemen, with most of whom I am personally acquainted, took counsel of their own sober judgment when they penned such letters. Had they read my letter a second time they would have seen that their labored efforts to prove that Mr. Griffith first suggested the idea of the Working Session were entirely unnecessary. I freely conceded that, and took pains not only not to bring any railing accusation against Mr. Griffith, but to praise him with all courtesy and heartiness for the share he had in the first session, at Chicago, and for the great success he made of the second at Rochester, and I had before taken special pains to acknowledge his great services to the society (v. Proc. Chicago meeting, pp. 251–2). I have not sought to revive a controversy, as I am charged with doing; there has been none. THE MICROSCOPE and other journals East and West have teemed for over a year past with high praises of the Working Session, and of Mr. Griffiith as its sole originator and architect, and I have kept silent, except to answer a few private letters of inquiry. After waiting so long for Mr. Griffith himself to make the correction, but in vain, I thought it allowable in me to set forth the facts as I did, briefly and in all courtesy. What controversy there has been between Mr. G. and the Publication Committee of the society in this connection, I have taken no part in, and shall not refer to now. The simple fact, whether "in a nutshell" or not, which I will state once more, is that however early Mr. Griffith and others may have suggested anything like the "Working Session," I never heard of any such proposal till long after I had myself planned and proposed such a scheme, and it had become an accomplished fact. I never heard that Mr. Griffith or any one else had suggested such a thing until some six months after the close of the Chicago meeting. In all the large correspondence I had on this subject with officers of the society, with Mr. Griffith himself, and with microscopists in all parts of the country, I received not a single intimation that such a plan had ever

before been proposed. While therefore I fairly concede to Mr. G., on his own statements and those of others, priority of suggestion of the idea of such a session, I unhesitatingly affirm that no such suggestion was made to me, but that the plan as carried out at Chicago was solely my own. Whether I joined the society at Detroit or at Ninevah does not alter or effect this. When Mr. Vorce, *et, al.*, testify to Mr. Griffith's speaking to them at Indianapolis, Elmira, or elsewhere, of such a scheme, prior to the Chicago meeting, or praise his success at Rochester, they have clear right to do so, whether it is called for by what I said, or not, but when they undertake to state what he or I did to bring about the first session at Chicago, they go entirely beyond the bounds of their knowledge, and are not valid witnesses. The "positive and clear statements of Mr. Brearley and Mr. Vorce" do not effect my statement at all. I wish no controversy with any one, and do not regard this as a matter worth controversy, and so shall not stop to notice any of the statements of these writers in detail, except to say that F. W. Taylor is entirely in error in saying that my remarks at Chicago, in reply to his resolution in favor of the Working Session, were "half-supporting, half-apologetic." His remarks afforded me great pleasure, endorsing so heartily as they did, the new departure I had labored so earnestly to bring about, and I so expressed myself in unmistakable terms, and took occasion, also, to recount the steps which I had taken to bring it about, and to publicly thank, in the name of the society, Mr. Griffith for his very valuable assistance, Mr. B. W. Thomas and others for their advice, and the gentlemen who took part in the session—including Mr. Taylor himself—for their cheerful and valuable services. I greatly regret, for more reasons than one, that the Proceedings, on p. 260, print a report of my remarks so very far from correct. It is, doubtless, that report which has so confused Mr. Taylor's memory.

Regretting the necessity which has arisen of again referring to this matter, I shall only say in concluding that if all dispassionate readers will again read what I wrote on pp. 5–7 of this journal of January, in connection with pp. 250, 251 and 260 of the Proceedings of the A. S. M. for '83, (incorrect as the latter page is) they will not, I think, accuse me of unfairness to Mr.

Griffith, and I will leave it to their judgment whether I or my critics have written in the spirit of controversy.

PARSONS COLLEGE, FAIRFIELD, IOWA.

OUTLINES OF EMBRYOLOGY.

THIRD PAPER.

d. Invagination and Formation of Germ Layers.

THE process of gastrulation described in the last number only occurs in eggs with a regular segmentation. When the cells are unequal a modification ensues which is sometimes carried so far that the hypoblast consists of but a few, or even one cell, over which the epiblast spreads itself, as shown in the accompanying figure. In this case the archenteron is absent, and the blastopore is represented by the edges of the epiblast.

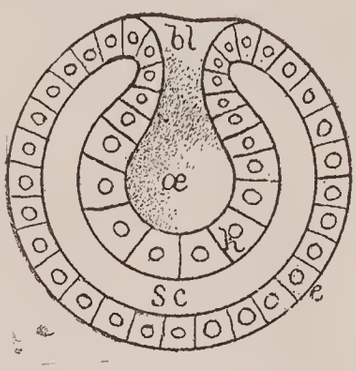
FIG. 1. Diagram of first and second segmentation of egg; at a, a nucleus is in process of division, showing amphiaster or "spindle kern."

FIG. 2. Segmenting egg of mollusc (Tergipes); the larger cells are macromeres, the smaller, micromeres.

FIG. 3. Diagrammatic section of blustula: b, blastoderm; s c, segmentation cavity.

Connected with the closure of the blastopore are many important things to be considered. It has long been known that the hypoblast forms the lining of the middle region of the alimentary tract, and hence the supposition was a natural one that this opening which connected this portion with the exterior should be either the mouth or the vent of the adult, but which one, was uncertain. In some it persisted as one, in other embryos as the other, and in still others it closed completely. Was the blastopore a different structure in all these various forms? It was not until Balfour studied the development of a curious worm-like animal known as *Peripatus*, that these various views

were reconciled. In several places he hinted at the explanation, and last year his pupil, Mr. Adam Sedgwick, of Cambridge, formulated the results. As far as we are at present concerned,



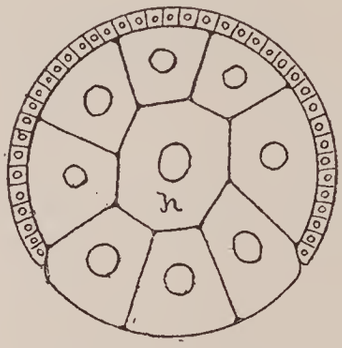


FIG. 4. Diagram of regular invagination. b l, blastopore; e, epiblast; h, hypoblast; æ, archenteron; s c, segmentation cavity.

FIG. 5. Diagram of epibolic gastrulation: h, solid hypoblast, the smaller cells are epiblastic.

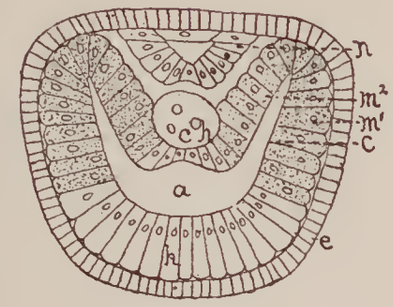
the conclusion is, that the blastopore is homologous with both mouth and anus, and that when it completely closes, these openings subsequently reappear in the line and within the limits of the primary blastopore.

This explanation doubtless contains the germs of the truth, and indeed it explains an enormous number of facts. There are still others which are yet to be brought into sympathy with it, but how is as yet uncertain. To mention only one, we would recall the mouth of the vertebrates. Is this homologous with that of the invertebrates, or is it a superadded feature?

Let us now consider the third of the embryonic layers, the mesoblast or mesoderm, as it occurs and is developed in the majority of animals. In the adults of all except some of the cœlenterates, and possibly some sponges, this layer lies between the hypoblast and the epiblast, and in the higher groups plays a very important part in the building up of the embryo. In the vertebrate, for instance, it forms the lower portion of the skin, the muscles, bones, heart, blood, connective tissue, excretory and reproductive organs; in fact, everything between the outer layer of the skin and the epithelium of the alimentary tract and its appendages, except the nervous system and one or two other structures which it is not necessary to enumerate here.

In the typical egg it has the development shown in the cut of the egg of *Amphioxus*, copied from Kowalewsky's memoir. The figure represents a transverse section, and shows but two

germ layers, the epiblast and hypoblast. The latter, however, is becoming folded, and forms two longitudinal pouches either side of the median line. With growth these become constricted off, their cavity becomes separate from that of the archenteron, and finally the walls themselves become separated. With this



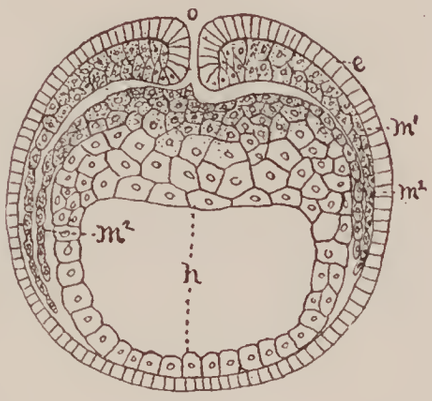


FIG. 6. Section of embryo of Amphioxus. a, archenteron; c, cœlomatic pouches; ch, notochord; m^1, somatoplure; m^2, splanchnoplure; n, neural cord.

FIG. 7. Egg of Newt. e, epiblast; h, hypoblast; m^1, somatoplure; m^2, splanchnoplure; o, blastopore.

separation the differentiation of the mesoblast is accomplished and the cavity of the mesoblastic pouches becomes the body cavity, or the cœlom.

This description applies, *mutatis mutandis*, to the origin of the mesoblast in various other forms—*Sagitta*, *Peripatus capensis*,* *Balanoglossus*, and several other forms. With an increase in food yolk the process becomes considerably modified, the pouches being brought nearer the mouth of the gastrula, until at last, as in the frog and newt, the mesoblast arises, not as pouches, but as solid bands, from the lips of the blastopore. All through our investigations we will constantly be brought into contact with food yolk and the influence it has on the growing germ. Indeed it is hardly possible to estimate its importance too highly. When abundant, the embryo can stay a long time in the egg, and there undergo most of its metamorphoses; when scanty, it is early compelled (except in the case of mammals) to leave the protective envelopes at an early stage of its development, and to undergo its changes in a state

* According to Kennel, another process occurs in two South American species of *Peripatus*.

of freedom, where it can obtain the food necessary for its growth.

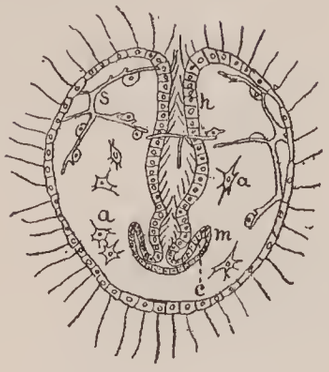


FIG. 8. Gastrula of a Holothurian. a, amœboid cells; c, cœlomatic pouches; h, hypoblast; m, mesoblast; s, spicules.

In other forms, as the Holothurians, another feature appears. As shown by the cut, the pouches are found much as in Amphioxus, but besides there is an inwandering of amœboid cells, and finally we have eggs in which the mesoblast wholly arises by this method. These points have been fully elaborated by the brothers Hertwig in their valuable paper on the "Cœlomtheorie," but for our purposes we need not enter into the various speculations connected therewith and the arguments *pro* and *con*.

In the case of Amphioxus, as illustrated above, the mesoblastic pouches contain a portion of primitive stomach or archenteron. After their separation from the hypoblast these spaces become, as we have said, the body cavity. In other forms, where the mesoblast grows in as a solid mass, the body cavity or cœlom appears by a splitting. The mesoblastic pouches continue to grow until finally the segmentation cavity is entirely obliterated. The outer part of the mesoblast (known as the somatoplure) unites with the epiblast, and the inner (the splanchnoplure) with the hypoblast.

Now, having studied the regular mode of formation of the germ layers, it may be well to say a word as to the parts to which each gives rise. The outer layer, the epiblast, forms the outer layer of the skin, the nervous system, almost all parts of the organs of sense, the various dermal glands, part of the teeth, and the anterior and posterior parts of the digestive tract. The hypoblast gives rise to the epithelium of the middle part of the alimentary canal, the lining of the lungs, air bladder, liver, and other digestive glands, and to the notochord of vertebrates. The mesoblast plays a more extensive rôle, if not so important an one. From it arise the muscles, genital organs, circulatory apparatus, blood, internal skeleton, urinary organs, dermal bones, and the like. It would be interesting to follow out these various organs in their development in various parts of the animal kingdom, but space does not permit. We must

proceed at once to those forms, the Insects, for which this series was planned and for which the preceding has been merely explanatory. But before doing so we must explain what the segmentation of the body, so prominent in the higher worms, the arthropods and the vertebrates, means, and how it arose, and this will be the subject of the next paper of this series.

The best single work in embryology is "A Treatise on Comparative Embryology," by F. M. Balfour, published in two volumes by Macmillan & Co. Next in order is "Outlines of Comparative Embryology," by A. S. Packard, published by Henry Holt & Co. On the points so far discussed in this series the reader will find some hints in a short series of papers (unfortunately never completed) by Dr. C. S. Minot, in the *American Naturalist* for 1881. The phenomena of maturition and segmentation are ably discussed in Dr. E. L. Mark's paper on the Embryology of Limax, published by the Museum of Comparative Zoology at Cambridge, and in the later Biologie Cellulaire of Carnoy. The formation of the egg in the various groups of the animal kingdom has been summarized by Ludwig in the first volume of Semper's "Arbeiten," and on this subject one should also consult the various papers of the younger Van Beneden. Less is known of the formation of spermatozoa, but some useful resumes by Bloomfield occur in various numbers of the *Quarterly Journal of Microscopical Science.* Fol's papers on the early stages of the star-fish egg occur in a Swiss journal; Balfour's abtract, however, will answer all ordinary purposes.

NEW METHODS OF WORK.

BY ALBERT E. JENKINS, ANN ARBOR, MICH.

A New Stain from the Huckleberry.

IN Volume XXIII of the "Archiv für Mikroskopishe Anatomie," Dr. Lardowsky describes a new stain, which he highly recommends for the karyokinetic figures and the cellulose walls of plants.

The fresh ripe fruit of the huckleberry, *Vaccinum myrtillus*, is washed in water, and the juice expressed and mixed

with twice its volume of distilled water, to which a trace of alcohol has been added. It is then boiled, and filtered while hot, the resulting fluid being of a clear deep-red color and faintly acid reaction. This, if kept in a cool place, will remain unchanged for a considerable time. Probably a crystal of thymol or of chloral hydrate would prolong the period. At the time of using, it is diluted with two or three volumes of distilled water, as it is quite thick when cold.

This solution stains red all objects hardened in chromic acid or chromium solutions. A beautiful violet stain, which is also more permanent than the red, may be produced as follows: The section is stained for one or two minutes as usual in the red fluid, then washed in distilled water and transferred to a one per cent. aqueous solution of lead acetate. Here it is watched until the red has changed to a lilac, when the specimen may be at once mounted in glycerine, or transferred through alcohol or clove oil to balsam.

A New Method of Using Hæmatoxylin.

The materials necessary for the new method of staining are a ½ per cent. solution of hæmatoxylin in distilled water, and a ½ per cent. solution of bichromate of potash. Small, well-hardened pieces of the organ or tissue to be stained are removed from alcohol to 8–10 cc. of the first solution, and are allowed to remain 8 to 10 hours, after which they are placed for a similar length of time in in the same volume of the second fluid. The object should then have assumed throughout its mass a uniform dark color. The excess of bichromate may then be removed by water, and the specimen placed in alcohol. Here it is kept until wanted, when it may be imbedded in paraffine or any of the usual mixtures, and thin sections made, which are cleared in turpentine or zylol, and mounted in balsam.

By this method the nucleus is stained black, the other tissue elements taking a more or less dark gray, or even blackish tint, but with this peculiarity, that the different structures can be easily distinguished one from another by their taking different *tones* of gray and black.

This manner of staining has the important advantage over

others, in which only the nucleus is colored, that the entire structure of the organ can be seen, all parts showing sharp and clear like a good wood-cut; whereas in the other case, many features are almost lost to view, especially in balsam mounts.

If instead of treating the preparation with bichromate of potash, a 1 per cent. solution of alum in distilled water be used, a beautifully shaded *blue* coloration is the result. ("Archiv für Mikroskopische Anatomie," B. 24, H. 3, S. 468.)

[TO BE CONTINUED.]

EXAMINATION IN HISTOLOGY AT THE UNIVERSITY OF MICHIGAN.

C. H. STOWELL.

THE following questions were asked at the final written examination in Histology, for the freshman class of the medical department of the University of Michigan, held March 14th. There were 200 papers presented. Each paper was carefully read and marked. In order for a student to "pass," he is obliged to have a mark of 70 on a scale of 100 :

1, Give the shape, size, color, and origin of the adult human red blood-corpuscle.

2. Describe any other elements normally found in blood.

3. What are epithelial cells? What are endothelial cells?

4. Describe the dental pulp.

5. Give the structure of non-striated muscle, and give places where it can be found.

6. What are the peculiarities in the structure of the heart?

7. Give the coats of a medium-sized artery, in proper order, from within out. Which is the thickest coat?

8. Name the parts, in proper order, over which air must pass in going from the trachea to the blind termination of the respiratory passages.

9. Describe the epithelial lining of the different parts of a uriniferous tubule.

10. Give the layers of the epidermis, and name the principal bodies found in the true skin.

11. Give the histology of a medullated nerve-fibre.

12. Describe the mode of termination of nerve-fibres ; a, for the sense of touch ; b, for the sense of taste ; c, for the sense of smell ; d, for the sense of sight (layers of retina).

13. Make a drawing of a transverse section of the spinal cord, and name the different parts.

14. Where can we normally find the following structures?

Yellow elastic tissue.
White fibrous tissue.
Osteoblasts.
Pacinian bodies.
Goblet cells.
Pigment Cells.
Columnar cells with long, basal processes.
Odontoblasts.
Stratified epithelium.
The largest nerve-cells.
Oval blood-corpuscles.
Nerve plexus of Auerbach.
Rods of Heidenhain.

EDITORIAL NOTES.

"ANYTHING TO WIN."—There is a certain editor of a cotemporaneous journal who finds his chief amusement in ridiculing anything that appears in this particular journal which departs in the least from his standard of dry, uninteresting, unpractical and purely theoretical science. He holds that white zinc cement is a worthless medium; and he did not like it when we said that we had finished five or six thousand specimens a year, for the past six or eight years, with this same medium, and with surprising good results. Dr. Frank L. James has sent a few dynamite charges into this editor's camp also, and how he did it is told on page 65 of our March issue. As each individual, however, has a right to his own opinion there is nothing very surprising in the above. Dr. James' shadow will not grow less as a result of it, and our own subscription list is rapidly and constantly increasing. What shall we say, however, when an editor is reduced to such an extremity that he will openly attack *a lady*, in the most unkind and ungentlemanly manner? When a lady is doing superior and honest work, and is just establishing a reputation for the ready sale of that work; when she goes so far as to present said editor with some samples of her work; what shall we say of the man who says in print, *"they are all defective, and the specimens are already ruined"? Our indignation is still further aroused at such pusillanimous meanness when we read that this lady said in her letter to the

* Am. Month. Mic. Jour, p. 39.

editor that she would "consider it as a favor" if any person who has received a slide not in good order, would return it at once, and she would cheerfully replace it. In the case before us, through some accident, "the slides were literally smashed to pieces, so that the glass was almost powdered." And the editor says in connection with the above, "the white zinc has been unable to withstand the conditions necessary to travel." Was anything ever written more ridiculous? Did the white zinc cause the glass slides to pulverize? Can it preserve glass slides from smashing to pieces? When we are so far reduced in our gentlemanly qualities that we are obliged to take advantage of a pure accident and severely attack the ability of an accomplished woman, may our dearest friends make microscopic sections of our heart in the vain hope of discovering some lingering trace of kindness and justice.

TO MISS MARY A. BOOTH we say: We have seen a large number of your mounts finished in white zinc. They are models of neatness and monuments to the preservative qualities of that medium. We know for years you have offered to replace any defective slide of yours; yet so great is our confidence in white zinc, and in your acknowledged ability to know how to use it, that we will give you two dollars for every slide thus far returned. Please tell us how much is your due, and we will remit by return mail.

THE WORKING SESSION.—In this number we print a reply by Prof. McCalla to the communications in our February number. The facts are these: In our January number Prof. McCalla favored us with a paper on the origin of the Working Session; in the February number some friends of Mr. Griffith replied; and now Prof. McCalla gives a rejoinder. Mr. Griffith has not sent us any paper on the subject, and it is evident he does not intend to do so. It is a subject that can never be settled, to the satisfaction of all parties, by any amount of writing. The claims of Prof. McCalla are before our readers, and they have doubtless been passed upon before this and a final conclusion in the case reached. We see nothing to be gained for either party or for this journal by further attention to the subject.

THE THIRD EDITION of our Manual of Histology came from

the press about the first of November last. We issued a large edition, but during the past five months very nearly one-third of the whole number has been sold The work has been re-written and newly illustrated, and changed from a small 8 vo. of 270 pages, to a large 8 vo. of 370 pages. We are especially desirous of having those who own copies of our former editions possess this work, which more nearly represents our present understanding of this difficult subject. To such persons we make the following offer: If you will mail us your copy of the old edition, we will deduct seventy-five cents from the regular price of the third edition, which is $3.50. Copies of former editions cost you but $1.25 each. Or if you will mail us your old copy we will send you a copy of the third edition and this journal one year for $3.50, which is the price of the book alone. This edition is so unlike its predecessor that it is practically a new book.

WE have seen a large number of slides of arranged diatoms, but the one lately presented to the Junior Editor surpasses them all. It is the work of Mr. J. C. Rinnbach, of 14, Simmering, Wien, Austria. It consists of 222 diatoms arranged in the most exquisite and artistic pattern. In a beautiful photomicrograph which Mr. Walmsley made of a slide arranged by this same party, and now in the possession, we believe, of Mr. Christian, of Richmond, Va., there are not quite as many diatoms and some are imperfect. In this slide each diatom appears perfect and in its right place. It is a marvel of workmanship. We shall try to induce Mr. Walmsley to photograph it for us.

WE call especial attention to some particular features of THE MICROSCOPE for this year. The articles on "Embryology"; the regular communications by Dr. Stokes; the "results of microscopical research"; the regular contributions by Prof. Moore; the regular translations giving "new methods of work"; all these are special features, and show the success of our journalistic enterprise. We have other features in course of development; but the growth will be much more rapid if our readers will simply show a copy of the journal, or mention it, to a friend interested in microscopical work.

THE number of new subscribers since January 1st, has been

both gratifying and unexpected. We have not a single set of back volumes, except a very few of volume 2 which we offer at $1.50 each. We have a few broken sets of volume 3, less the April number. These sets contain 192 pages of reading matter; they will be mailed to our subscribers for fifty cents each.

DR. HENRI VON HEURCK, of Amers, Belgium, has succeeded in photographing the *beads* of the *amphipleura pellucida*. Prof. Abbe agrees with him that the "beads" are genuine, and not the result of any optical illusion. We, Americans, should bear in mind, however, that the slide from which this photograph was made, was prepared by Dr. A. Y. Moore, of Cleveland. It was one of Dr. Moore's silver-plated slides. We have seen one of these photographs and the appearance of the *beads* is unmistakable.

DR. W. R. CHITTICK, of Detroit, favors us with a very good slide of the Bacillus Tuberculosis.

WE have received one of the slides of Comma Bacilli, as prepared in Kock's laboratory. These slides are sold by Mr. Woolman, of New York, and they certainly show the bacilli very nicely.

R. R. ASKS for the best method of mounting chemical crystals. Will some one inform him?

REVIEWS.

NATURE'S SERIAL STORY. By Edward P. Roe, author of "Barriers Burned Away," etc. Fully illustrated. pp. 430. Harper & Bros., New York, 1885.

Many of our readers are familiar with the charming style of Mr. Roe's writings. The language in the story before us in the author's happiest vein. Mr. Roe writes: "I am getting very tired," said a hard brain-worker to me once. "Life is beginning to drag and lose its zest." In reply our author says: "This is an experience that can scarcely happen to one who has fallen in love with nature, or become deeply interested in any of her almost infinite manifestations." It is the object of the book to bring one into closer sympathy with nature; to make

one love the soil and all the pursuits of out-door life. Such writings cannot fail to develop in any reader's heart a love for nature that never fails both to purify and exalt.

The copy before us is prepared especially for the library table. It is embossed in gold in a very attractive manner. The profuse illustrations are unique, and many of the more beautiful ones are already familiar to the readers of *Harper's Monthly*.

INDEX MEDICUS.

As an indication of the unusual interest Mr. Geo. S. Davis, of Detroit, has always manifested in everything that promises good to the medical profession, we take pleasure in announcing that he has undertaken to continue the publication of the "Index Medicus" on the same general plan, and with the same regard to typographical accuracy and finish, as heretofore.

On account of the delay required to perfect this arrangement, the first number of the journal for the current year will comprise the literature of January, February, and March, after which it will appear monthly, as usual.

At the end of the year, in addition to the usual index of names, subscribers will be furnished with an index of subjects to the volume.

So many expressions of regret and urgent remonstrances in regard to the threatened discontinuance of the "Index Medicus" have been received, that we think we may venture to congratulate the profession on Mr. Davis's public-spirited determination to carry on the enterprise in spite of the fact that thus far it has not been pecuniarily remunerative.

It is requested that all exchanges, and books and pamphlets for notice, be sent to the "Index Medicus," Washington, D. C.

THE PHYSICIAN HIMSELF, AND WHAT HE SHOULD ADD TO HIS SCIENTIFIC ACQUIREMENTS. By D. W. Cathell, M. D., late of the College of Physicians and Surgeons, Baltimore, Md. A handsomely bound octavo volume, 284 pages, pica type, which can be obtained from almost any bookseller in the United States by showing him this as a guide, or it will be sent by mail to any address on receipt of $2.00. Fourth edition. Cushings & Bailey, publishers, 262 W. Baltimore st., Baltimore, Md.

It is only necessary to call attention to this work to insure

the sale of another edition by the author. Three times have we reviewed it before, and with increasing feelings of gratitude to the author each time. How so much common-sense advice ever emanated from one brain is a mystery to us. The book is worth a hundred times its cost to any young practitioner, and a thousand times to the old fossilized antiquarian, who, doubtless, could not be induced to read it, for he "knows it all, already."

ALCOHOLIC DRINKS. By T. B. Stowell, A. M., Ph. D., Professor of Natural Sciences, Cortland, N. Y. 1885. pp. 25. Price, 25 cents.

The author has undertaken to meet the alcohol question from a new standpoint, the key of which is found on page 5, where he says: "The study of alcoholism is primarily one of circulation." The argument used to prove this is at once unique and strong. The author says that the medical profession alone must determine whether alcohol should be administered; the laity are incompetent to judge. The question, the author says, "is one of cell-function." The lecture has been delivered in public very many times, and with good effect, judging from the fine notices of the press.

VEGETABLE HISTOLOGY. By D. P. Penhallow, B. S. Large 8vo. pp. 40. Price, $1.00. S. E. Cassino, Boston. 1882.

This work contains tables for use in the study of vegetable histology. The more prominent reagents are given, and their uses described. It enables the student to have his work-table always ready for immediate and constant use. The publisher's work is very neatly done.

PALATABLE PRESCRIBING. By B. W. Palmer, A. M., M. D. Small 8vo. pp. 136. Geo. S. Davis, Detroit. 1885. Price, $1.00.

In this little volume there are collected the favorite prescriptions of the most eminent English, German, French and American authorities of the age. The information given is of immediate use in practice, and will be a help to medical men in various ways. It tells the favorite remedies used in certain diseases, and their doses. It tells also what remedies are successfully combined to meet certain indications. Although as a rule the physician prefers to do his own prescribing, yet in another sense this book becomes to him a text-book.

THE CENTURY.

In the April number there is a striking paper on "The Opening of the Lower Mississippi," by Admiral Porter. At the beginning of the paper Admiral Porter says: "The New Orleans campaign was the most important event of the War of the Rebellion, with the exception of the fall of Richmond." The first edition of this number reaches 225,000 copies.

PERFORATED LABELS.

We are in receipt of a lot of perforated adhesive-exchange-list-labels from "The Illustrated Medical Journal Company," of Detroit. We await, with interest, future announcements from this house. No man knoweth what they will be; labels, books, slips, tags, virus, blanks, stamps, or chromos.

MIND IN NATURE, 171 West Washington street, Chicago.

We are in receipt of the first nnmber of this journal, devoted to psychical, medical and scientific information. It is filled with very readable matter treating of the relations of the mind to the body, with special reference to the medical bearing of the subject. It will make a very popular and useful journal.

THE ART INTERCHANGE. 140 Nassua street, New York.

This is an illustrated fortnightly journal, containing illustrated articles on artistic designs, painting on wood, glass, china, etc., wood carving, etching, brass hammering, and all allied subjects. Colored supplements, full page, are numerous. Price $3.00 per year, or fifteen cents per single number.

THE DIATOMACEÆ.

Dr. H. H. Chase, of Geneva, N. Y., is about to issue an editon of Habirshaw's Catalogue of the Diatomaceæ, containing in addition to the original, all references to all works published up to the present time. It will be printed on fine paper, on one side of the sheet, by the duplicating process. Price, payable on completion, bound in cloth, $12.00.

DRUGS AND MEDICINES IN NORTH AMERICA. Cincinnati, Ohio.

The March number of this quarterly contains a continuation of the article on Hydrastis Canadensis, its physiological effects and therapeutical uses. This work is only $1.00 a year.

THE BAY STATE MONTHLY.

The March number contains sketches of the lives of Messrs. Lee & Shephard, the well-known publishing firm of Boston. Two fine steel plates of these men illustrate the article.

VICK'S FLORAL GUIDE.

Full of illustrations, and handsome as ever.

"BE SURE YOU ARE RIGHT, THEN GO AHEAD."—We are in receipt of a circular from the Trommer Extract of Malt Co., in which Dr. J. E. Clark, of the Michigan Medical College, Detroit, Mich., states that Maltine (Reed & Carnrick's) is "almost inert as a digestive agent," and adding that Trommer's extract "is immensely superior." To this wholesale charge, Messrs. Reed & Carnrick reply in a circular just at hand. They give the testimony of Prof. A. B. Prescott of the Univ. of Mich., Prof. Wm. Roberts of England, Prof. Chittenden of Yale, Prof. Haines of Chicago, and many others, to prove that Maltine has at least *twice* the digestive power of Trommer's Malt. It is a scathing rebuke to the author of the first circular, and will carry conviction to every fair minded man that thus far Maltine heads the list.

SOME of the cuts for the articles on "The Vorticellæ" and "The Microspectroscope" were lost on their way from the engravers to this office; hence the non-appearance of these articles in this number.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

FOR SALE OR EXCHANGE.—Green and blue stains for 10cts. an ounce. Sections of wood, various kinds from 1-500th to 1-1500th inch thick for 10cts. per dozen.
J. D. BECK, Liberty, Pa.

WANTED to exchange a Seiler's section knife carrier (new) for a good microtome or turn-table.
J. T. WAID, M. D., Ridgway, Pa.

WANTED—Microscope stand and microscopical books and journals. Will give various articles or cash for same, Send for list. C. VON EIFF, Jr. 347 Greenwich St., New York City.

WOULD like to exchange a 1-6 in. object, drv, 160° for a first-class microtome.
J. B. JENNINGS, 78 Mayor block, Chicago, Ill.

WILL EXCHANGE—Parlor Billiards $25, printing press outfit $25, galvanic battery $5, crayon drawing cabinet $5, self-adjusting skates $8, and various books $12; for a good microscope with or without objectives; or for microscopical journals.
C. VON EIFF, Jr. 347 Greenwich st., New York City.

TO EXCHANGE—Pulvermacher chain battery (100 clements) for applying electricity to the body —cost $30 for cheap microscope stand, slides, minerals or lantern slides.
J. CROWTHER, 320 Pleasant St., Fall River, Mass.

FOR SALE.—A Tolles first-class 1-15 objective, 170° objective immersion. Cost $120.00, will sell cheap; or would exchange for first-class, wide angle objectives of lower power.
J. B. MARVIN, M. D., 903 4th ave., Louisville, Ky.

IN EXCHANGE for "THE MICROSCOPE" for 1884, I offer the "Science Review" (English) Vol. I.
Address, A. B. AUBERT, Orono, Penobscot Counnty, Maine.

FOR EXCHANGE—A good refracting telescope 2¼ in. operture which will resolve Epsilon Lyra with half inch eye piece—value $65, will exchange for a first-class Bausch & Lomb objective.
J. E, WHITNEY, Rochester, N. Y.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg. Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

WILL exchange mounted slides of various minerals (native crystals), and others, for well mounted slides. WILL H. OLMSTED, Syracuse, N. Y.

EXCHANGE.—Parties having diatomaceous earths or other microscopical material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow, Msss.

SEVERAL Photographic Instruments, list of photo California Views, on paper 5x8, or stereo, or same on glass for magic lantern; upwards of 100 oil, four-inch paintings of foreign scenes, for lantern; to exchange for good microscope stand and accessories, slides, etc.
R. E. WOOD, St. Helena, Napa Co., California.

QUEEN'S New Sub-Stage Condenser, with dividing combination for high or low powers, and three Caps, for sale or exchange. DR. A. C. STOKES, Trenton, N. J.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a varicty of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FRESH-WATER ALGÆ, nearly all genera, and many beautiful varieties; also Euglena, Astasia, etc., for good pathological or other interesting slides. Lists exchanged.
J. M. ADAMS, Watertown, N. Y.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

HISTOLOGICAL SLIDES, very thin and evenly cut, well mounted and well ringed, will be exchanged for Pathological or Histological slides only.
H. L. WHITNEY, M.D., German Hospital, Philadelphia, Pa.

FOR SALE. CHEAP—A Bausch & Lomb Dissecting and Compound Microscope (as figured in their Catalogue, p. 6); has a Wales dividing objective ½ to ⅔, two simple lenses 1½, hand rests, eye shade, etc. GEO. TIMMIN, Syracuse, N. Y.

WILL GIVE a good bargain in micro-objectives, new, made in 1884, for a Morrison *wide angle* view lens, for 5x8 or 6½x8½ photo-plates. Write for particulars.
JOHN D. WHITE, Chicopee, Mass.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

EXCHANGE.—I have about one hundred lantern slides to exchange for microscopical apparatus (object-glasses), etc. W. S. WHITE, 128 and 130 Main St., Kalamazoo, Mich.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

FOR SALE.—Slides, double stained, of Bacillus Tuberculosis, 50c. each.
DR. W. R. CHITTICK, 83 Lafayette Avenue, Detroit, Mich.

WANTED.—Books treating on microscopical and histological subjects not already in my possession. Will pay cash, or give slides in exchange. State name of the work, date of issue, and price. C. H. STOWELL, Ann Arbor, Mich.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

PATHOLOGICAL, Histological, and other well mounted slides will be exchanged for mounted specimens of interest. Lists furnished on application.
D. E. HAAG, M.D,, Liberty Center, Henry County, Ohio.

THE MICROSCOPE.

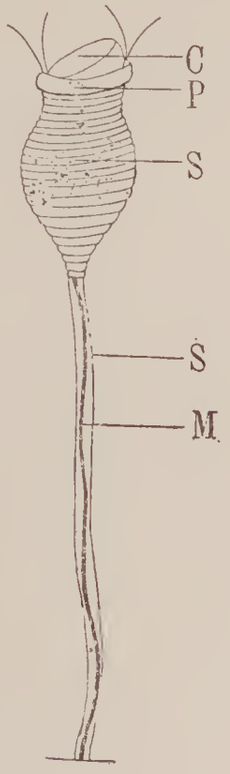
VOL. V. ANN ARBOR, MAY, 1885. No. 5.

ORIGINAL COMMUNICATIONS.

A KEY TO THE VORTICELLÆ.

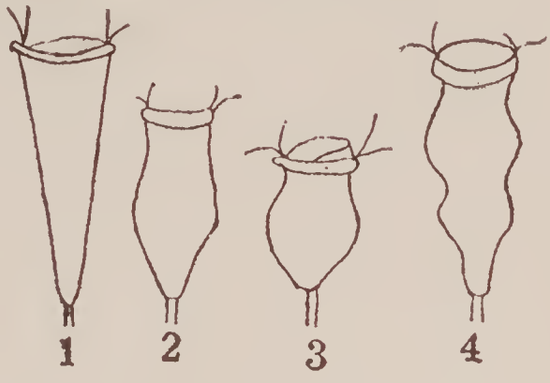
DR. ALFRED C. STOKES, TRENTON, N. J.

THE following scheme for the rapid identification of unrecognized or imperfectly remembered forms of this extensive generic group has proved so convenient that it is here published, in the hope that it may be as useful to the readers of THE MICROSCOPE as it has been to the writer. Information in respect to errors or omissions will be received gladly.

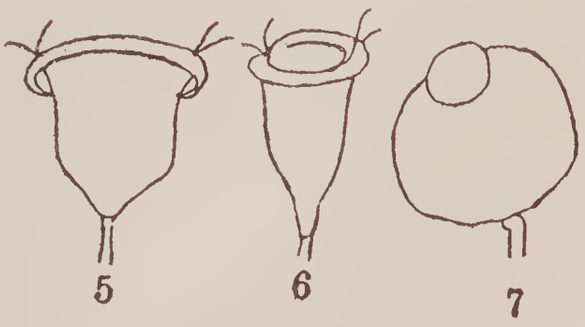


Different Parts of a Vorticella.

C. Ciliary disc.
P. Peristome.
S. Striated body.
M. Muscular thread surrounded by s, sheath, both forming the pedicle.



1. Conical, v. macrophya.
2. Elongate, v. utriculus.
3. Ovate, v. striata.
4. Subcylindrical, v. quadrangularis, S. K.



5. Broadly campanulate, v. Lockwoodii.
6. Conical-campanulate, v. chlorostigma, Ehr.
7. Spheroidal, v. globularis, Mull.

With an amplification of 350 diameters or less.

A. Surface smooth (B).
A. Surface striate or otherwise ornamented (C).
B. Body conical or elongate (†).
B. Body broadly campanulate (††).
B. Body spheroidal (†††).
C. Body conical or elongate (*).
C. Body broadly campanulate (**).
†. Body three times, or more, as long as wide (ʔ).
†. Body twice, or less than three times, as long as wide (ʔʔ).
†. Body once and one-half, or less than twice, as long as wide (ʔʔʔ).
††. Width of frontal border exceeding length of body (‡).
††. Width of frontal border equal to or less than length of body (‡‡).
†††. Pedicle 6 to 7 times as long as the body (a).
†††. Pedicle 2 to 3 times as long as the body (b).
*. Body transversely striate only (e).
*. Body with an external, cuticular investment (f).
**. With an external *cellular* investment------- *V. vestita*, Stokes.
**. With transverse striæ only (p).
**. With solid or nucleated bead-like cuticular elevations (r).
ʔ. Conical-campanulate; ciliary disc not elevated; peristome oblique; pedicle 4 to 5 times as long as the body.---------- *V. nebulifera*, Ehr.
ʔ. Conical elongate; ciliary disc elevated, cushion-like; peristome not oblique. (Pedicle not recorded)------- *V. cucullus*, Duj.
ʔʔ. Body conical or conical-campanulate (¶).
ʔʔ. Body ovate (¶¶).
ʔʔʔ. Campanulate; peristome border undulate,uneven; pedicle thick, less than twice as long as the body. ------ *V. dubia*, From.
ʔʔʔ. Ovate; pedicle 3 to 4 times as long as the body, inserted into a depression in the posterior extremity. --- *V. fluvialis*, From.
ʔʔʔ. Ovate; pedicle 3 to 4 times as long as the body; no posterior indentation, but with an annular line around the posterior third. Social.---------- *V. alba*, From.
¶. Conical-campanulate; pedicle 4 to 5 times as long as the body, enclosing minute, linear, scarlet corpuscles. *V. picta*, Ehr.
¶. Conical; transparent. In stagnant marsh-water. (Insufficiently characterized.)---------- *V. gracilis*, Duj.
¶. Conical; pedicle 10 to 12 times as long as the body.---------- *V. longifilum*, S. K.
¶. Conical; with 2 transverse furrows, behind each of which the body abruptly narrows, and over which it contracts telescopically. ---------- *V. telescopica*, S. K.
¶¶. Pedicle decumbent, ½ as long as the body, contracting to ½ a single spiral turn. ---------- *V. brevistyla*, D'Udek.

¶ ¶. Pedicle 3 to 4 times as long as the body. Social. *V. alba*, From.

¶ ¶. Pedicle little longer than the body, very thick anteriorly, tapering to its posterior attachment. Social. *V. crassicaulis*, S. K.

‡. Parenchyma densely granular centrally; pedicle thick, 4 to 7 times as long as the body. Social. ------ *V. campanula*, Ehr.

‡. Parenchyma transparent, pale yellow; tomato or melon-shaped when contracted; pedicle 4 to 5 times as long as the body. Social. ---------- *V. citrina*, S. K.

‡. Parenchyma white; peristome border flattened, expanded, crateriform, often frill-like; pedicle 5 to 8 times as long as the body. Social. ---------- *V. cratera*, S. K.

‡. Parenchyma transparent, colorless; body minute, $\frac{1}{800}$ inch; pedicle stout, 4 times as long as the body --- *V. communis*, From.

‡‡. Body conical-campanulate (‖).

‡‡. Body broadly campanulate (‖ ‖).

‖. Fresh-water. One and one-fourth times as long as wide, apparently having a thick membrane around the junction with the pedicle. ---------- *V. aperta*, From.

‖. Fresh-water. About as long as wide; pedicle 4 times as long as the minute ($\frac{1}{800}$) body. ---------- *V. communis*, From.

‖. Salt-water. Transparent, tapering in straight lines; pedicle 3 to 4 times as long as the body. Social. ------ *V. patellina*, Mull.

‖ ‖. Colorless, or yellowish; oblique or pendulous, posterior extremity conical; pedicle 3 to 4 times as long as the body. Social. *V. nutans*, Mull.

‖ ‖. Hyaline; pedicle decumbent, 3 to 4 times as long as the body. *V. procumbens*, From.

‖ ‖. White; posterior extremity narrowly truncate; pedicle short. *V. dilatata*, From.

‖ ‖. Green; pedicle 3 to 6 times as long as the body. Social. -------- *V. fasciculata*, Mull.

a. Peristome small, contracted, not everted. Social. On *Cyclops*. *V. globularia*, Mull.

b. Peristome with 2 to 3 nipple-like papillæ (c).

b. Peristome without nipple-like papillæ (d).

c. Peristome narrow, with 3 papillæ. ------ *V. mamillata*, From.

c. Peristome very narrow, with 2 papillæ; contracted pedicle zigzag. ---------- *V. constricta*, From.

d. Ciliary disc small, contracted; body $\frac{1}{820}$ in. long. ---------- *V. sphœrica*. D'Udek.

d. Ciliary disc very minute; body $\frac{1}{400}$ in. long, enclosing refringent corpuscles. ---------- *V. margaritifera*, From.

e. Less than twice as long as broad (g).

e. Twice or more as long as broad (h).

f. Cuticular investment mucilaginous, enclosing scattered, bacteriform bodies.---- *V. rhabdophora*, Stokes.

g. Peristome ½ as wide as the body-center (j).

g. Peristome equaling or exceeding the body-center (k).

h. Peristome narrower than the body-center (i).

h. Peristome equalling or exceeding the body-center (m).

i. Body 2 to 3 times as long as wide; peristome about ⅔ as broad as the body-center, with an anterior, nipple-like projection when contracted; pedicle 3 to 4 times as long as the body. *V. putrina*, Mull.

i. Body twice as long as wide; peristome about ¾ as broad as the body-center, without nipple-like projection when contracted; pedicle 3 to 4 times as long as the body. *V. utriculus*, Stokes.

j. Fresh-water; pedicle 2 to 6 times as long as the body, which is often sub-spherical.---- *V. microstoma*, Ehr.

j. Salt-water; pedicle twice as long as the ovate body. *V. striata*, Duj.

k. Sheath of the pedicle apparently twisted, 7 to 9 times as long as the body; peristome exceeding the body-center.---- *V. octava*, Stokes.

k. Sheath of the pedicle not twisted; parenchyma colorless or whitish (l).

l. Fresh-water; pedicle 10 to 12 times as long as the conical-campanulate body.---- *V. macroeaulis*, Stokes.

l. Salt-water; pedicle 4 to 5 times as long as the conical-campanulate body.---- *V. marina*, Greeffe.

m. Pedicle long, more than 3 times the length of the body (n).

m. Pedicle short, less than 3 times the length of the body (o).

n. Parenchyma green, densely granular; pedicle 4 to 5 times as long as the body.---- *V. chlorostigma*, Ehr.

n. Parenchyma colorless; body 2 to 3 times as long as wide; muscular thread finely granulate.---- *V. elongata*, From.

n. Parenchyma whitish or hyaline; pedicle 3 to 6 times as long as the body. Stagnant water and infusions. *V. convallaria*, L.

o. Pedicle usually less than twice as long as the obliquely set, colorless body.---- *V. hamata*, Ehr.

o. Pedicle stout, 2 to 3 times as long as the colorless, erect, conical body; peristome slightly wider than the body-center.---- *V. macrophya*, Stokes.

o. Pedicle short, or 2 to 3 times as long as the brownish, erect, conical body; peristome much wider than the body-center. *V. spectabilis*, S. K.

o. Pedicle 1½ times as long as the body, which is subcylindrical, 3½ times as long as wide, with 2 anterior and 2 posterior projecting angles.---- *V. quadrangularis*, S. K.

p. Colorless; pedicle 5 to 6 times as long as the minute ($\frac{1}{2000}$ in.) body.---------- *V. microscopica*, From.

p. Colorless; pedicle enclosing numerous green corpuscles. -------- *V. appuncta*, From.

p. Green, homogeneous; pedicle 8 to 10 times as long as the body. *V. smaragdina*, Stokes.

r. Bead-like cuticular elevations solid.------- *V. monilata*, Tatem.

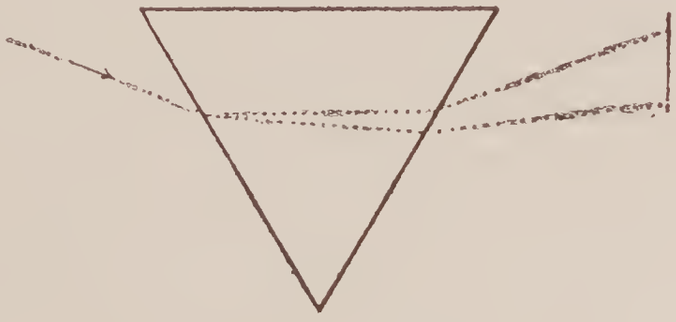
r. Bead like cuticular elevations nucleated. *V. Lockwoodii*, Stokes.

THE MICROSPECTROSCOPE.

BY PROF. A. Y. MOORE.

THE Microspectroscope, as used in the form of a spectroscopic eye-piece, is one of the most convenient ways of examining the light transmitted by various objects, both solid and liquid, and of determining the position of the dark bands produced in the continuous spectrum by the absorbtion of certain colors of which light is composed.

The principle of the spectroscope is comparatively simple. A beam of light is admitted through a very narrow slit, after which it passes through a prism of flint glass as is shown in Fig. 1.



By the unequal refrangibility of the various colors which compose white light, this narrow beam of light is spread out into a band of colors, the length of which will depend upon the dispersive power of the glass of which the prism is made, and the distance of the screen upon which the band is received; while the width is simply dependant upon the length of the slit. The order of the colors, starting with the least refrangible end, is dark red, red, orange, yellow, green, blue, and violet.

It will be seen from Fig. 1 that the beam of light (which is represented by the dotted lines) is refracted as well as dispersed. This is a great inconvenience when this form of prism is used

in the construction of the Microspectroscope, hence a "direct vision" prism is commonly used. This is a compound prism consisting of three or more simple prisms as shown in Fig. 2.

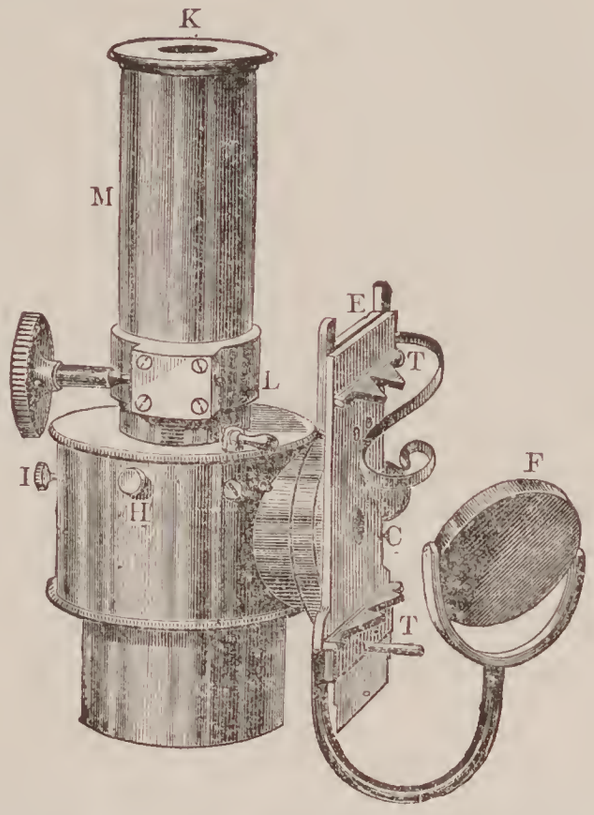
Two of these are made of crown glass, which, while having the same refraction as the two crown glass prisms, greatly exceeds them in dispersive power. Thus it is, that while the ray of light is dispersed by passing through this form of prism, it is not refracted—that is, the middle of the spectrum (green) is in a straight line with the incident beam. A prism of too great dispersion should not be used with the Microspectroscope for reasons which will be given further on.

The construction of the microspectroscope is similar to that of a two-inch eye-piece, with the slit placed in the focus of the eye-lens, the latter being achromatic and adjustable for focus upon the slit. Above the eye-lens is placed the compound prism. The slit is made adjustable for width and length and in the more complete forms of the instrument a small right-angled reflecting prism may be drawn over half of the slit so that light may be reflected from some lateral source through it. In such arrangements the side of the instrument is provided with a small stage and mirror; the former for holding any material whose spectrum is to be compared with the object on the stage, and the latter to reflect the light through that object.

Fig. 3 will give a very good idea of the external appearance of the spectroscopic eye-piece as made by R. & J. Beck, which is the form I use.

The compound prism is contained in the tube M, which also carries the achromatic eye-lens adjustable by the large milled head. At H is shown the milled head for the adjustment of the width of the slit, while the lever L adjusts its length. The milled head I, is for bringing the comparison prism down over half of the slit, so that the spectra of objects upon the stage E, may be compared with those upon the stage of the microscope. For the convenient holding of bottles or tubes containing solu-

tions, this side stage is provided with two sliding ledges and a spring as shown at TT. The milled head C regulates the quantity of light transmitted to the reflecting prism, which is sent from the small mirror F.



To use the spectroscopic eye-piece it should be inserted into the upper end of the tube, and the slit opened wide. The tube containing the prisms should be so turned that the latter stands upright—otherwise a distortion of the spectrum will be produced. Light should be reflected by the mirror of the microscope into the body, and the slit gradually narrowed. It should then be focussed upon by turning the large milled head. If bright daylight should have been used, and the slit properly brought into the focus of the eye lens, the spectrum will be seen crossed by a great number of fine dark lines; the more prominent of which are known as Fraunhofer lines. These are shown on the plate. The one marked F is the extreme dark red, and is seen with extreme difficulty unless the brighter yellow part of the spectrum be shaded or covered in some way. The colors corresponding to the various parts of the spectrum are indicated in the figure, but it must be remembered that there is no abrupt change from one color to another. The red, for example, is very dark near the line A, but becomes progressively more brilliant and lighter as we go towards C, from which position it goes through the various shades of orange, nearly to the

D line, at which point the color is a bright yellow. So it is with the other colors. The blue becomes very dark at G, and is commonly called indigo.

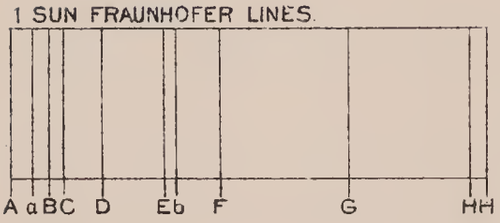
If a little fresh arterial blood be now placed upon a slide covered with a thin cover-glass and placed upon the stage, in addition to the narrow Fraunhofer lines will be seen two broad dark bands, one in the yellow and the other in the green. It will also be noticed that from a little to the left of F, the light is entirely gone from the blue end of the spectrum. These dark bands are produced by the absorption of the colors which correspond to their position, as it passes through the object. It will further be noticed that the edges of these absorption bands are not sharp and distinct, but rather nebulous, shading off gradually. If a thin solution of blood should be used, or the layer be very thin the lines are correspondingly faint, and if the layer be increased in thickness the bands become darker and wider, without, however, altering their position as regards the centers of the bands.

If the spectrum, as produced by passing through blood, be compared with that of any other fluid or solid, it may be done by drawing down the milled head which moves the comparing prism. If the light be then reflected upon this prism by the small mirror, two spectra will be seen side by side. The tube, bottle or slide should then be placed upon the small stage, over the central hole, and held in position by the ledges and spring.

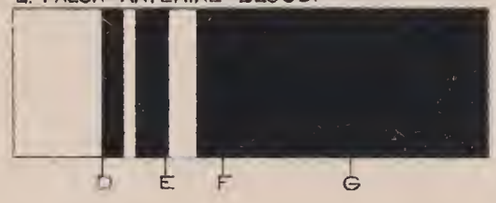
If it be desired to preserve a map of the spectra, it may be done by noting the position of the bands as regards the principal lines, or a spectrum scale may be used, which consists of a polarized plate of quartz, which gives a series of dark lines across the spectrum, with which the bands may be compared. One of the most convenient methods, however, is by using the camera lucida. The cap (K) of the instrument may be removed and the camera put in its place; then by placing the microscope stand in a horizontal position, the position of the lines may be accurately mapped. If used by a lamplight even this method will necessitate the use of a standard scale or some fixed line. For this purpose I use the bright line of sodium vapor which is shown in No. 12 of the plate. This line may be produced by putting a small quantity of common salt on the

MICROSPECTROSCOPIC MAPS.

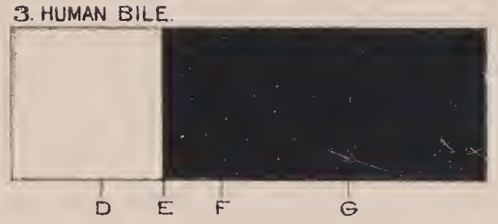
1 SUN FRAUNHOFER LINES.



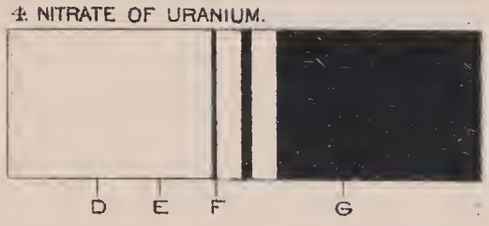
2. FRESH ARTERIAL BLOOD.



3. HUMAN BILE.

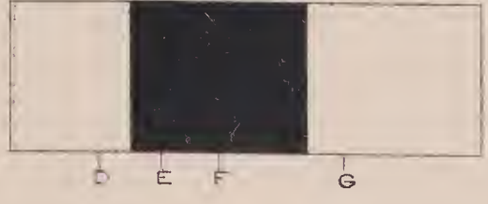


4. NITRATE OF URANIUM.

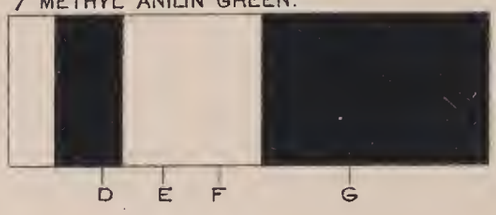


5. EOSIN, THICK SOLUTION.

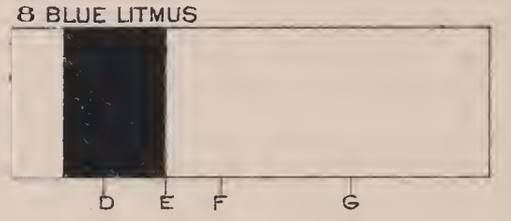
6. EOSIN, THIN SOLUTION.



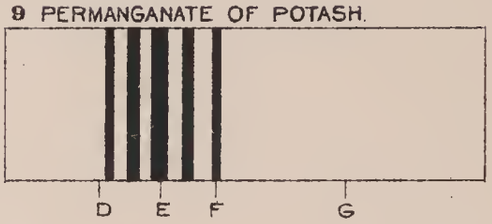
7 METHYL ANILIN GREEN.



8 BLUE LITMUS

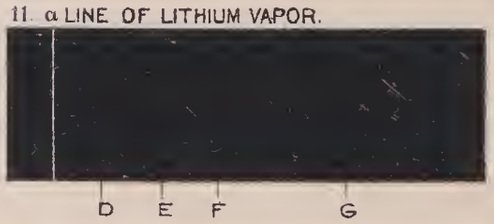


9 PERMANGANATE OF POTASH.

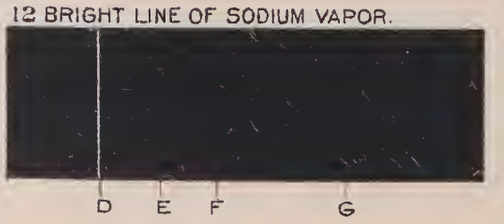


10 SULPHATE OF NICKEL.

11. a LINE OF LITHIUM VAPOR.



12 BRIGHT LINE OF SODIUM VAPOR.



wick of an alcohol flame and bringing this light into the instrument by reflection from the small mirror. This will enable the observer to produce a map in which the bands will coincide in relative position to such spectra as may be mapped in daylight.

If the spectrum of a very small object is to be examined, the tube containing the prisms should be removed and the slit opened wide. The object should then be placed upon the microscope stage and focussed as under ordinary conditions. The objective used should be as low a power as will show the object properly. The latter should then be brought to the center of the field, and the slit closed; also the side shutter should be closed by the two small levers, so that no light can pass through the slit except that which passes through the object. Then by throwing the object slightly out of focus and replacing the tube containing the prisms, its spectrum will be seen.

For fluids small glass cells should be used, and it is frequently convenient to have them made wedge-shaped, so that different thicknesses of the solution may be examined. At times, when the solution contains but little color, it becomes necessary to use very deep cells, so that a considerable thickness may be used. For this purpose glass tubing may be cut in short pieces, the desired length, and after grinding the ends off flat, cementing them to the ordinary slides by marine glue.

The thickness of the solution will make a great difference in the spectrum. No. 5 of the plate shows the result of a thick solution of eosin. Only a little of the less refrangible end of the spectrum is transmitted, while in No. 6, which is produced by a thinner solution, a large part of the blue end is transmitted. If a still thinner solution be used, the result will be a narrow band at E. If a thicker solution of permanganate of potash than the one which produces the spectrum shown at No. 9, be used, the five comparatively narrow bands become so wide as to run into each other, and thus produce one very broad band somewhat similar in position and width to that of the thin solution of eosin. Thus it will readily be seen that varying thicknesses of the substance should be examined until the characteristic bands are obtained. When the bands are very faint a prism giving a short spectrum should be used; as they then appear very iutense. In no case, however, is it of any very

great advantage to use a prism of very great dispersion; for if this be done the bands are rendered so wide and nebulous as to be seen only with great difficulty.

This instrument is hardly suited to the study of those bright lines which are given by the glowing vapors of the various metals, etc., as its dispersive power is not sufficient to separate them enough to be accurately mapped. Still many of them can be determined providing the lines are few and quite far apart. To determine the pressure of a well known element in this way, it is not always necessary to obtain the entire number of lines which its glowing vapor will give; but simply select the *characteristic*, or *a* line as is shown in No. 11, of the plate which represents the brilliant red *a* line of lithium vapor as given by an alcohol flame. The other line of the spectrum of this metal is fainter, of an orange color, and in position a little to the left of D. However, the determination of the exact position of the red line is sufficient in determining the presence of lithium.

For the determination of the presence of such metals as only volatilize by exceedingly high temperature, electricity may be had recourse to, by way of a spark from the Ruhmkorf induction coil, or the oxy-hydrogen blow-pipe may be used.

Prof. Sorby has recently devised a form of microspectroscope which is used as an objective— that is it screws to the nose of the microscope. This may be used with the binocular, but is not as well suited for accurate work as the form here described.

PROF. W. A. ROGERS, of Cambridge, has presented us with an exceedingly rare and valuable slide, of "glass threads." The ruling diamond has thrown up an even, unbroken windrow of glass, on the side of the groove it cut. These windrows are made in rulings, only under certain rare conditions, and Prof. Rogers has only obtained a very few of these slides in all the years of his work.

IN the article by Dr. Stokes the sentence "with an amplification of 350 diameters or less," immediately under the illustrations, has no reference to the figures and should be placed at the top of the key, forming the first line.

OUTLINES OF EMBRYOLOGY.

FOURTH PAPER.

Metameric Segmentation.

ALMOST all animals above the Protozoa may be readily divided into two groups; in the first the body consists of a series of somewhat similar segments arranged one after another in serial order, while in the other no traces of this segmentation occur. In the Cuvierian system of classification there was recognized a group of animals, under the name Articulata, the fundamental character of which was this segmentation of the body. Later studies have shown that this segmentation or metamerism is not confined to the articulates, but occurs in other groups.

To understand better the extent of this metamerism, let us examine one of the animals in which it is best developed; for instance, an angle-worm. Externally, we see that the body is composed of a long series of rings arranged one after another, rendering the segmentation of the body apparent to the most casual observer. With a low power (or even with the naked eye) we can see on each segment a pair of bristles used in place of legs. When we dissect the worm we find that this same segmentation occurs in almost every organ. The nervous system has a ganglion in each segment, the muscles are correspondingly arranged, there is a pair of excretory organs in each ring, the heart extends through all, as also does the digestive tract, while the reproductive organs alone are confined to one portion of the body, and even these exhibit a tendency toward metameric repetition. Each ring of the worm contains a portion of all the systems except the reproductive, and is essentially like its fellows. In some nearly allied forms the reproductive organs form no exception.

This serial repetition of parts is also well illustrated in the vertebrates, especially in the lower forms and in the larval stages. The nervous system is composed of a number of ganglia arranged one after another; the vertebral column consists of separate bones corresponding to the ganglia. In the muscles of the trunk (especially in the fishes) the same is seen,

while in the young the uro-genital system exhibits metamerism in a marked degree. The heart is but a specialized portion of the aorta, which at first extends as a simple tube the whole length of the body. Among the other forms which exhibit this serial repetition of parts are most of the higher members of the old, but heterogeneous group of worms, the brachiopods, the arthropods (Crustacea and Insects), and to a less extent the Mollusca. In this last group segmentation appears in only a few instances, and in a limited number of organs. The chitons have it best developed.

To account for this serial repetition of parts, two theories are prominent. The first to be mentioned is the older. As is well known, reproduction by division is common among many of the lower invertebrates. In some cases the body becomes long, and then divides at or near the middle. Each half reproduces all the parts of the parent. The division is not instantaneous, but gradual. A constriction appears on the surface, and gradually sinks in until at last a complete separation is effected. Sometimes, before the first division is complete, a second one sets in, and in turn a third. This is well illustrated in *Microstomum*, as described by Graff. In *Microstomum Catenula* and

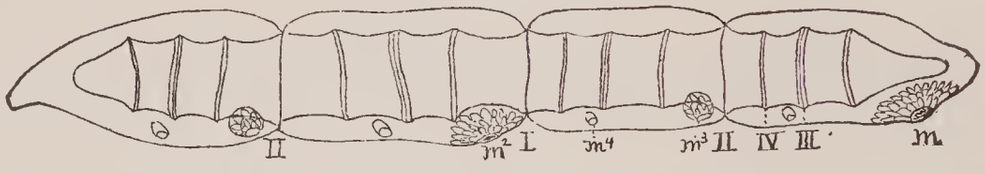


FIG. 1. Self division in *Microstomum* (after Graff). I, II, III, IV, lines of successive divisions; *m*, mouth of the whole animal; m^{2-3-4}, mouths of the successive generations.

allied forms the division is eventually completed, but we have only to imagine the partially divided form to become permanent and we have metameric segmentation. The tape-worms need but be alluded to as an instance of this.

The other hypothesis is more recent and more complicated, though, on the whole, far more satisfactory. The germs of the idea were first advanced by Arnold Lang, and afterward carried out farther by Balfour, Wilson, and especially by Sedgwick. It has the merit of introducing homology throughout almost the whole of the Metazoa.

The ancestral form to which almost the whole animal king-

dom is traced is anatomically much like a sea-anemone or other actinozoan. It is sac-like in shape, and has, on one of the surfaces, an elongate opening,which serves not only as mouth, but for the rejection of the fæces as well. Surrounding this mouth is a ring of epiblast, specialized as a nervous system. Cutting a section below the mouth (in the position the animal usually occupies), we find a central digestive cavity, and radiating from it a series of pouches (*p*) by which the assimilative surface is

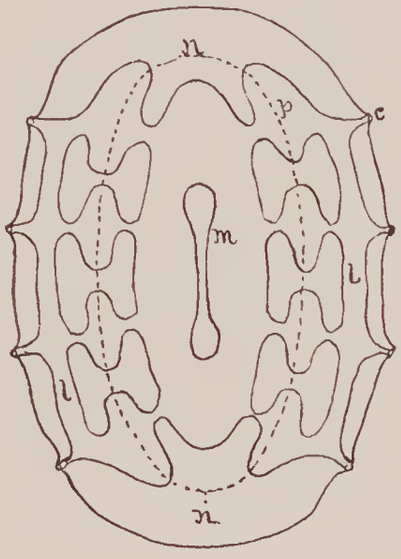


FIG. 2. Diagram of the structure of a sea-anemone, the section passing through the radial partitions and the digestive cavity. *c*, cinclides or openings from the archenteric pouches (*p*) to the exterior; *l*, longitudinal canals passing from one pouch to another; *m*, mouth; *n*, nervous ring; the last two being in a plane above the rest of the section. This represents Sedgwick's ancestral form.

greatly increased. These pouches are connected with one another by openings through the partitions (*l*), and each (in some genera) with the exterior by other apertures, the so-called cinclides (*c*). These points are all of the anatomical features that need here be noticed.

There are some embryological points which need mention. The actinian is but little removed from the gastrula; its "mouth" is the blastopore, and its digestive cavity is the archenteron. To gain additional absorptive surface, the archenteric walls become folded so that they form a series of pouches connected with the central cavity; and it is to be noted that these pouches, in their mode of origin, are comparable to the cœlomatic pouches of Amphioxus, previously described. They are diverticula of the primitive stomach of the gastrula.

Observation has shown that in several of the Actinozoa the different regions of the mouth have different functions. In shape, the mouth is more or less oval, or even slit-like. At one end a current of water is drawn in, bringing with it oxygen and food, while at the other end the current flows in the opposite direction. We have only to conceive the "mouth" closing in the middle to get a veritable alimentary canal, (with mouth and anus) traversing the length of the body. It has recently been shown that in several forms (*Peripatus*, *Serpula*, etc.,) the blastopore does thus close in the middle, the ends remaining open and forming the mouth and anus of the adult. Further, the digestive pouches of the sea-anemone need only to become separated from the central cavity to become comparable to the cœlom, and the walls to the mesoblast, of the higher animals.

With the closure of the mouth in the middle, the sides of the nervous ring would be drawn closer together, and then the animal might be described in the following manner: It has an elongate body with a mouth near one end and an anus near the other, the alimentary canal traversing the distance between them. On either side are a series of closed sacs arranged one after another; while the nervous system consists of two cords parallel with each other and with the intestine, and connected with each other in front of the mouth and behind the intestine. If now transverse connections arise from one nervous cord to the other between the mouth and the anus, corresponding in number and position to the cœlomatic pouches, the definition, so far as it goes, will apply perfectly to an insect, a worm, or a crustacean; with one exception,—the nervous loop behind the anus, and even this persists in some forms. Taking away the nervous loop in front of the mouth, as well as that behind the intestine, and the description applies to a vertebrate. Thus as will readily be seen, our sea-anemone is converted into a segmented animal. We have derived from it a segmentation of the body cavity, a mouth and anus, and a longitudinal nervous cord. Other metameric structures can be derived from it.

It will be remembered that the pouches of the sea-anemone were connected with each other and with the exterior. These external openings, among other functions, have that of affording a passage of waste products from the body. If we now con-

ceive the canal connecting the various pouches to be closed, and those leading to the exterior to become specialized, we

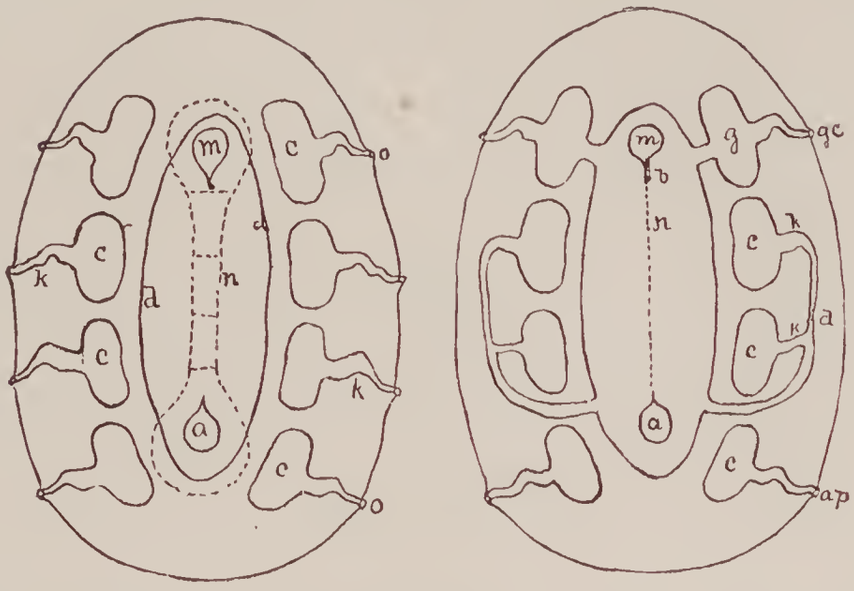


FIG. 3. Diagram of Invertebrate stock: a, anus; c, cœlomatic cavities; d, outline of alimentary tract; k, kidneys; m, mouth; n, nervous system; o, outlet of kidneys.

FIG. 4. a, anus; ap, anal pore; b, brain; c, cœlom: d, nephridial duct; g, gill cleft; k, kidney; m, mouth; n, nerve.

shall obtain the type of the kidneys occuring in the invertebrate series.

In the vertebrates the kidneys open into the alimentary tract, and not directly to the exterior. If we close up the external openings (cinclides) of the sea-anemone, and allow the longitudinal canal to remain open, portions being specialized as before, the result will be a type found in the vertebrates, the longitudinal canal forming the duct.

Besides the kidneys the gill clefts of vertebrates are metanurically arranged. These, according to Sedgwick, are derived from one of the pouches of the sea-anemone, which retains its connection both with the alimentary tract and with the exterior, but loses that with the longitudinal canal.

We cannot descend into details, but would refer the reader to Mr. Sedgwick's admirable paper for a full exposition of his views and the arguments in favor thereof. It will be found in the *Quarterly Journal of Microscopical Science* for January, 1884. It is well to say, in passing, that so far as it goes this theory well accords with the teachings of embryology, and, while it has its faults, it explains more facts than any other yet advanced.

One point which remains unsolved relates to the relation of the mouth to the brain in the vertebrates and invertebrates. In the latter the œsophagus passes through the nervous cord (vid); fig. 3, in the vertebrates no such perforation occurs. There are two prominent theories to account for this. One supposes that the supra-œsophagal ganglion of the invertebrates has disappeared from the vertebrate series, and that our brain corresponds with the infraœsophagal ganglion of the lobster or grasshopper. The other takes the ground that, in the evolution of the vertebrates, the invertebrate mouth has disappeared, and a new one has formed. This view seems the more probable. It generally strives to recognize the old mouth in the otherwise inexplicable infundibulum and pituitary body. It supposes the existing mouth to have arisen by a coalescence of gill clefts, a view which receives much probability from the mode of origin and development of the upper and lower jaws.

GOLD AND SILVER FERNS.

L. G. DOANE.

UPON a slip of glass put a drop of liquid Auric Chloride or Argentic Nitrate, with half a grain of metallic zinc in the Auric Chloride, and copper in the silver. A growth of exquisite gold and silver ferns will grow beneath the eye.

A HANDSOME FINISH FOR SLIDES.

J. E. HAYS, M. D.

TAKE one of the packages of "Gold or Silver Paints" put up by Wells and Richardson, of Burlington, Vt., and sold in connection with their "Diamond Dyes" and add it to one-half an ounce of the best Damar Varnish, warming the varnish so as to make the paint mix with it well, and apply with fine brush. The paint will settle to the bottom upon standing, but by warming a little and shaking well it is diffused again. This makes a very pretty finish and adds strength to the cover cement as well.

WE have a large number of preparations in our cabinet, mounted by Cole, of London. They were all finished with white zinc and not a single slide is imperfect to-day.

SELECTIONS.

MEASUREMENTS OF BLOOD CORPUSCLES.

Respecting the alleged uncertainty of expert testimony in this department of legal medicine, it is possible that the following measurements may be of interest to the readers of the *Legal News.*

The human blood from which these measurements were made was obtained from the finger of Mr. Henry L. Tolman April 6, 1885, spread in a thin film on two thin cover glasses, and measured within an hour thereafter by M. Tolman and Marshall D. Ewell, M. D., at their respective homes, and no comparison of results was made until the work was completed.

Fifty corpuscles were measured on one slide by Mr. Tolman, and twenty-five on another slide by Dr. Ewell.

Mr. Tolman's measurements were made with a Spencer homogeneous immersion 1-10 objective, numerical aperture 127, a ¾ inch eye-piece, a Rogers eye-piece micrometer ruled to 1-1,000 inch, and the value of each division was determined from a Roger's stage micrometer, ruled on glass to 1-2,000 inch.

Dr. Ewell's measurements were made with a Spencer homogeneous immersion 1-10 objective, numercial aperture 135, a Bausch & Lomb achromatic amplifier giving about 2,000 diameters, a Bullock cobweb eye-piece micrometer, each division of which represents an absolute movement of 1-400 millimeter (1-10,000 inch), and is equal to 1-1,000,000 inch on the stage. The value of a division was determined from a Rogers stage micrometer 4-10 inch long, ruled to 1-200 inch, the correction for the entire length being 3-1,000,000 inch at 62 degrees Fahrenheit. The tube length was 8.91 inches.

	Number Corpuscles.	Diameter, Largest.	Diameter. Smallest.	Average.
TOLMAN	50	1-2709"	1-3522"	1-3139"
EWELL	25	1-2817	1-3521	1-3138

The difference between 1-3,138 and 1-3,139 equals 1-9,850,-182 inch; or in other words the results are practically identical. While of course, these measurements have no tendency to prove the possibility of identifying blood by the diameter of the corpuscles, they are admissible to show that *under exactly*

the same conditions there is an average diameter of the blood corpuscles of an individual which varies within exceedingly narrow limits, and that this diameter may be measured with very great accuracy. The limits of error certainly fall within the 1-200,000 of an inch and probably within the 1-250,000. Whether this average diameter varies from time to time is a question not yet determined.—*Legal News.*

THE MICROSCOPE is an illustrated monthly journal edited and published by Charles H. and Louisa Reed Stowell, Ann Arbor, Mich. It is the only journal devoted solely to microscopy, in this country, that can lay any claim to genuine merit.—*Bistoury.*

KOCH'S "comma Bacillus" appears to be having a hard time of it among the experts. First, Dr. Klein showed his contempt of it by swallowing it, and now Dr. Lancaster has the unkindness to say: First, it is not comma-shaped. Second, it is not a bacillus. Third, it does not always occur in the intestines of cholera patients, and Fourth, there is no good evidence that inoculation with it produces cholera. In fact, the poor thing appears to be about annihilated by its critics. Cholera, though, will remain undisturbed by it, and relentlessly claim its thousands of victims as heretofore.

PROFESSOR STOWELL, in a recent private letter, speaks enthusiastically of the present status of microscopical literature in general, and of the prospects of his journal, THE MICROSCOPE, in particular. He says, that if the outlook continues as bright as at present, he will on December 1st announce an "enlargement." The profession, as well as the professor, is to be congratulated, for THE MICROSCOPE is one of the liveliest and newsiest of our technical journals, and merits all the favor which it is meeting.—*National Druggist.*

PROF. COHN, of Breslau, one of the best authorities on Bacteria, has recently called attention to the remarkable work of Leuwenhoek done in this same department of research more than two centuries ago, before the compound microscope came

into use. This pioneer microscopist observed in the cleanings of his teeth several kinds of organisms which are now known to belong to the Schizophytes, and described them so accurately that they are easily recognized. One he said "resembled a rod" (bacillus); others had the habit of "bending in curves" (bacteria); others of "creeping in a snake like fashion;" and another kind, "extremely minute, resembled a swarm of flies rolled up in a ball" (micrococcus). When it is remembered that this group of plants is the most minute of all organisms, it is a matter of astonishment that this old naturalist should have been able to see so much with such imperfect instruments as were at his command. His microscopes were beads of glass of various sizes which he made himself. It affords another illustration of the fact that genius consists in the power of doing much with little.

DR. FRANK L. JAMES, of St. Louis, Mo., has charge of the department of "Microscopy" in *The National Druggist*, published in that city. He has already given over twenty chapters on "Elementary Technology," and he has proved himself a terse and vigorous writer. The articles are very valuable indeed and we hope the doctor will put them in permanent book form.

ASK any microscopist in the country "who prepares the best slides for market," and you will get but one reply, "Arthur C. Cole, of London." Why are they the best? Because the objects, themselves, are always first-class; because they are models of beauty and neatness; and because they remain unchanged for years.

DR. F. L. JAMES, of St. Louis, sends another dynamite charge into an editorial camp, under the title of "A Savant and a Snob." Our readers can find it in *The National Druggist*. Dr. James is making the department of "Microscopy" the most interesting part of that journal.

IF anyone should ask Mr. Cole, of London, why it is that he finishes all his mounts with white zinc, he would doubtless reply "because it is the best."

REVIEWS.

MICRO-CHEMISTRY OF POISONS, including their Physiological, Pathological, and Legal Relations; with an appendix on the detection and microscopic discrimination of blood. By Theodore G. Wormley, M. D., Ph. D., LL. D., 8 vo. pp. 784, 96 illustrations on steel. Second edition. J. B. Lippincott Company, Philadelphia, 1885. Price, $7.50.

The second edition of this valuable work is just from the press. The purpose of the author has been to prevent the study of the chemical properties of poison as revealed by the aid of the microscope. How well this has been carried out, all readers of the first edition are aware. It is an acknowledged fact that in this department, Prof. Wormley stands without a rival; in fact, he is so far removed, by his superiority, from other writers on the subject that he stands alone as *the only authority*.

We are first given the definition of a poison, causes which modify the effects of poisons, their classification, evidences of poisoning, and the various re-agents used. Then follows a study of the inorganic poisons and vegetable poisons. The "appendix" consists of about fifty pages on the Nature, Detection, and Microscopic Discrimination of Blood. The author says that in medico-legal practice, when any account is given of a suspected stain, the primary question usually presents itself under one or other of the following forms: 1st. Is the suspected stain blood? 2d. Is it the blood of an *oviparous* animal? 3d. Is it, or may it be, that of a specific mammal, or may it be human blood? We read—"It has been asserted that the crystals from the blood of different animals differ somewhat in appearance; but this is an error, since they are essentially the same in form and character as produced from the blood of all vertebrate animals."

Another conclusion reached is given thus—"Hence, then, the microscope may enable us to determine with great certainty that a blood is *not* that of a certain animal and is *consistent* with the blood of man; but in no instance does it, in itself, enable us to say that the blood is really human, or indicate from what particular species of animal it was derived."

The steel engravings are works of art of themselves; none

the less so from the fact that they were drawn from nature and engraved by the accomplished wife of the author.

No microscopist's library can be considered at all complete without this valuable work.

A COMPLETE GUIDE TO THE USE OF THE MICROSCOPE IN BOTANICAL RESEARCH. By Dr. Julius Wilhelm Behrens. Translated and edited by Rev. A. B. Hervey, A. M., assisted by R. H. Ward, M. D., F. R. M. S. Illustrated with 13 plates and 153 cuts. S. E. Cassino & Co., Boston. 1885. Large 8vo. pp. 466. Price $5.00.

This is the only work in any language which undertakes to cover the whole field of histological research in botany and does it with a thoroughness and completeness characteristic of the work of all first-class German naturalists.

It begins with a brief account of the microscope itself, its use and care, and gives a plain description of all necessary accessory apparatus, particularly such as are needful in the several departments of microscopical measuring, drawing, photography and spectroscopy, also of the tools, and manipulations, and of the best preserving, staining, mounting and other fluids and media for the preparation and permanent mounting of micro-botanical specimens.

It enumerates and describes the preparation and application of all tested and accredited re-agents used in the microscopical investigation of vegetable elements and finally it gives at length, and in full practical detail, all the best methods of investigation with reference to each of these substances.

We have frequently called attention to this promised work as one that would be very welcome "when it should finally come from the press of this well known Boston firm." The book is now before us and all workers in "botanical research" will hasten to avail themselves of it.

COMPARATIVE ANATOMY OF THE PHANEROGAMS AND FERNS. By Dr. A. DeBary, Professor in the University of Strassburg. Translated by F. O. Bower and D. H. Scott. Illustrated with 242 cuts. Large 8vo. pp. 660. Price $5.50. 1884. MacMillan and Co., New York.

This work is of the utmost value to students of botany. It treats, in a most exhaustive manner, of the various forms of vegetable tissues, their origin, development, modifications and

various changes. It is a text-book on vegetable histology of the highest order and it is safe to say there is no more valuable work of its kind extant. We present, therefore, in the three works received above, three most valuable additions to microscopical literature.

AMERICAN MEDICINAL PLANTS. By C. F. Millspaugh, Binghamton, N. Y. Published by Bœricke and Tafel, New York and Philadelphia. Fascicle II. Price $5.00.

This is the second series of plates and accompanying descriptions devoted to plants used in homeopathic pharmacy. There are 166 large plates in this second collection, illustrating the phænogams, under the class, dicotyledons. The plates are all drawn from nature and colored as closely as possible like the original plants. The artistic beauty of the work is of a very superior order; and to all those interested in general medical botany, especially homeopathic medical botany, the whole work will be of the greatest value.

CONSUMPTION. Its Nature, Causes, Prevention and Cure. By J. M. W. Kitchen, M. D. 12 mo. pp. 225. Price $1.50. G. V. Putnam's Sons, New York. 1885.

This excellent manual treats of a disease which "probably sweeps from life each year over three million members of the human race." But ten pages are devoted to "the office of medicines" in the treatment of this disease. The bulk of the work is devoted to the "relation of man's surrounding conditions to phthisis." The climate, temperature, moisture, foods, dress, habits and the like are carefully considered. The subject is treated with intelligence and thoroughness and contains a great deal of common-sense and knowledge in little space.

THE LONDON MEDICAL STUDENT AND OTHER COMICALITIES. Selected and compiled by Hugo Erichsen, M. D. pp. 200. Price $2.00. Address the author at 11 Farmer St., Detroit, Mich.

The *London Medical Student* is a reprint of a story that appeared some time ago in the *London Punch*. It portrays in a sparkling manner the medical-student-life in that large city. There is also a collection of "*Medical Anecdotes*," which, if read, will go a long ways toward "driving dull care away." The stories about doctors and their patients are not usually of a very dull character, hence if you wish to "laugh and grow

fat" you had better buy two dollars worth of this "ready wit and overflowing humor."

"A joke well administered often removes bile better from the body (and soul) of an irritable patient than any of the most potent drugs."

QUARTERLY COMPENDIUM OF MEDICAL SCIENCE. Edited by D. G. Brinton, M. D., and J. F. Edwards, M. D. April, 1885. Single copies, 75 cents. $2.50 a year. Address the editors at No. 115 South 7th St., Philadelphia.

THE CENTURY.

The May number starts out with 250,000 for the first edition. The war articles include "Incidents of the Battle of Manassas;" "Manassas to Seven Pines;" "Recollections of a Private;" "The Peninsular Campaign," and "The Military Career of Gen. Grant." We are informed that over a hundred tons of paper were used to print this edition.

MIND IN NATURE. $1.50 a year. Chicago, Ill.

The May number is well filled with curious experiences of various persons, and with able articles on "Consciousness;" "The Supernatural," and the like.

HISTORY OF CHINA. By Robert K. Douglass, Professor of Chinese at King's College, London. 12 mo. pp. 570. Illustrated. Price $1.50. D. Lothrop & Co., Boston.

This sixth volume of Lothrop's Historical Library is just from the press and is in keeping with the preceding volumes of the same series. The text is made much more interesting by the large number of illustrations of Chinese scenes and customs. The work is writen in a free and pleasing style and the whole series, taken together, will fill the corner of the library devoted to "History" to perfect satisfaction. For the other volumes see our advertising pages.

OUR new subscribers have rushed upon us to such an extent that we have sold all our back numbers, even up to date, with the single exception of six sets of Volume II, which we now offer at $1.00 each to close out the lot. We have about ten sets of the June, August, October, and December numbers of 1883. There are 192 pages of reading matter. These we will sell for 50 cents each, or exchange.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

FOR SALE OR EXCHANGE.—Green and blue stains for 10cts. an ounce. Sections of wood, various kinds from 1-500th to 1-1500th inch thick for 10cts. per dozen.
J. D. BECK, Liberty, Pa.

WANTED to exchange a Seiler's section knife carrier (new) for a good microtome or turn-table.
J. T. WAID, M. D., Ridgway, Pa.

WANTED—Microscope stand and microscopical books and journals. Will give various articles or cash for same, Send for list. C. VON EIFF, Jr. 347 Greenwich St., New York City.

WOULD like to exchange a 1-6 in. object, dry, 160° for a first-class microtome.
J. B. JENNINGS, 78 Mayor block, Chicago, Ill.

WANTED.—One second-hand turn table; also one second-hand section cutter for soft material; also one second-hand micro-dictionary. Above must be very low priced and in fair order. Send description of style and cost to E. S. COUTANT, 1022 Woodland ave., Des Moines, Iowa.

WILL EXCHANGE OBJECTIVE.—An adjustable Nachet 1-9 (dry)—society screw, with *very long* working distance—has moderate angle. Correspondence solicited.
E. T. BECKWITH, M. D., Urbana, Ohio.

TO EXCHANGE—Pulvermacher chain battery (100 elements) for applying electricity to the body—cost $30 for cheap microscope stand, slides, minerals or lantern slides.
J. CROWTHER, 320 Pleasant St., Fall River, Mass.

IN EXCHANGE for "THE MICROSCOPE" for 1884, I offer the "Science Review" (English) Vol. I.
Address, A. B. AUBERT, Orono, Penobscot Counnty, Maine.

FOR EXCHANGE—A good refracting telescope 2¼ in. operture which will resolve Epsilon Lyra with half inch eye piece—value $65, will exchange for a first-class Bausch & Lomb objective.
J. E, WHITNEY, Rochester, N. Y.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg. Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

WILL exchange mounted slides of various minerals (native crystals), and others, for well mounted slides.
WILL H. OLMSTED, Syracuse, N. Y.

EXCHANGE.—Parties having diatomaceous earths or other microscopical material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow. Msss.

QUEEN'S New Sub-Stage Condenser, with dividing combination for high or low powers, and three Caps, for sale or exchange. DR. A. C. STOKES, Trenton, N. J.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FRESH-WATER ALGÆ, nearly all genera, and many beautiful varieties; also Euglena, Astasia, etc., for good pathological or other interesting slides. Lists exchanged.
J. M. ADAMS, Watertown, N. Y.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

HISTOLOGICAL SLIDES, very thin and evenly cut, well mounted and well ringed, will be exchanged for Pathological or Histological slides only.
H. L. WHITNEY, M.D., German Hospital, Philadelphia, Pa.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

FOR SALE.—Slides, double stained, of Bacillus Tuberculosis, 50c. each.
DR. W. R. CHITTICK, 83 Lafayette Avenue, Detroit, Mich.

WANTED.—Books treating on microscopical and histological subjects not already in my possession. Will pay cash, or give slides in exchange. State name of the work, date of issue, and price. C. H. STOWELL, Ann Arbor, Mich.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M. D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

PATHOLOGICAL, Histological, and other well mounted slides will be exchanged for mounted specimens of interest. Lists furnished on application.
D. E. HAAG, M.D,, Liberty Center, Henry County, Ohio.

THE MICROSCOPE.

VOL. V. ANN ARBOR, JUNE, 1885. No. 6.

ORIGINAL COMMUNICATIONS.

THE MICROSCOPE IN MEDICINE.

BY C. H. STOWELL.*

IT is within the memory of us who are only in middle age that the majority of the people, including the medical profession, regarded the microscope as an elegant play thing, adapted only to the wants of the wealthy and idle. Thirty years ago the man who purchased a microscope was derided for his foolish expenditure. But the brilliant discoveries of Ehrenberg and others taught the whole world what things were in store for those who availed themselves of this new means of research.

So complete and satisfactory has been the work accomplished with this instrument during the past century that it would take a life-time to review it.

It has been called "the only perfect instrument of research," by which is understood that it is the only product of man's constructive genius whose performance equals its theory.

The past few years have given us more convenient and tasty stands; superior objectives; improved methods of illumination; the spectroscope; the photographer's plate; accurate micrometry; many useful accessories; and, not the least important, great reduction in price.

We regard it as an instrument worthy of being placed in the hands of the young, simply from the refined taste and the appreciation of the beautiful that must necessarily result from its intimate acquaintance.

It is an instrument that has revolutionized the sciences of

* Read before the Michigan State Medical Association, June 11, 1885.

zoology and botany and has made heavy inroads on the old accepted theories of medicine.

But it is the purpose of this paper to show some of the relations of the microscope to the practice of medicine. Let us listen to some testimony on this point:

Prof. Thos. F. Rochester, of Buffalo, in a public address said: "A physician must either be himself a microscopist, or must have almost daily recourse to one, for the necessary information to practice his profession correctly and conscientiously, not to say successfully."

Dr. J. G. Richardson, of Philadelphia, in his hand-book of microscopy says: "At least one-half of the cases of disease which physicians are called to treat would have some light thrown upon their nature by a careful examination of the blood, urine, sputum, etc., with the microscope." (A rather high estimate). Dr. Robt. Todd, Dr. Lionel Beale, with many other authors give universal testimony to the diagnostic value of the microscope; while scores of active practitioners give their united approval of its use from daily experiences.

The following are *some* of the uses of the microscope in practical medicine: *First*,

IN THE DIAGNOSIS OF DISEASE.

Under this head I would refer to the results obtained from the following examinations: A, *of the urine.* It will require no extended remarks in this connection to show the aid that comes to the diagnostician from a knowledge of the presence, in undue proportions, of the normal ingredients of the urine, or of the presence of abnormal products. There are some ailments and some serious diseases that can be diagnosed with certainty *only* by possessing such knowledge, while in many other instances it furnishes a prompt and easy method of verifying a doubtful diagnosis which only time (or a post mortem) could make clear.

B, *of the skin.* Dr. Yemans says, "as accuracy of diagnosis is the key to success so here we must rely upon the microscope for necessary precision." Cases of *favus* were formerly treated many times for months and years with no relief, while the microscope was ready to indicate the treatment and diminish

the time of recovery to as many days or weeks. Take the large class of skin diseases caused by vegetable parasites. It is simply impossible to diagnose some of the forms of *tinea*, with the minute mycelium and still more minute spores, without the aid of the microscope. As these diseases are parasitic, the low vegetable growth being not very unlike ordinary mould, so only such local applications are required, as a rule, that will destroy the life of the plant, as preparations of mercury, sulphur, tar, etc.

C, *of the blood.* A casual examination will enable us to determine approximately whether the normal relation between the red and white corpuscles is maintained and whether there are any marked changes in the appearances of those bodies. By the additional aid of a "*corpuscle-counting*" apparatus, we are able to determine with great accuracy, whether the blood contains the normal amount of corpuscles to the cu. mm. whether the relation of the two corpuscles to each other is normal, and of course by repeated examinations whether our special treatment is giving desired results. I purposely omit in this connection, any reference to the various forms described by a few writers, as ever present in certain diseases.

D, *of the sputa*, for lung tissue; of the contents of the oral cavity as for the vegetable parasites of *apthæ;* of vomited matters; of fæcal matter for tæniæ, echinococci, etc.; of milk to determine its richness or to discover adulterations.

E, *of muscle.* It might be necessary in a medico-legal case to examine the muscle of the heart to determine whether there was any degeneration present or not. Principally however the practitioner would examine this tissue for the purpose of discovering the presence of that troublesome little worm, the *trichina spiralis.* Here even it will be necessary for the observer to have the glasses of his instrument free from *dust* or he may see, as has been reported, in place of the trichinæ some wonderful new vegetable parasitic growth.

The microscope is useful in practical medicine, *second*,

IN THE DETECTION OF FRAUD.

The microscope has many times exposed the false claims of irresponsible practitioners. Notably so in a case in this state,

where a pseudo-surgeon reported the removal of a peculiarly shaped tumor from the cavity of the uterus. A microscopical examination of a portion of the growth showed it to consist of the stomates and spiral vessels of the vegetable kingdom, perhaps a portion of a cabbage leaf. I examined a portion of a tumor, said to have been removed from the uterus, which was composed of *striated* muscle. As the fee received was $75.00 it can truly be said that this is doubtless the highest price ever paid for half a pound of *beef-steak*. Such cases could be multiplied from my own experience. *Third*,

IN THE DETECTION OF ADULTERATIONS OF POWDERED DRUGS.

As this field is an exceedingly broad one the active practitioner will necessarily be limited in his work. However it is a fact that two or three of the common starches are most frequently used as a base for adulterated mixtures and as it is very easy to become familiar with these starches, so their presence is at once detected. *Fourth*,

IN CORRECTING DIAGNOSES.

In "Bennett's Clinical Lectures," we read: A child was supposed to be affected with worms, because it passed in abundance yellowish shreds, which to the naked eye, closely resembled ascarides. All kinds of vermifuge remedies had been tried in vain. On examining the shreds with the microscope, I found them to consist of undigested spiral vessels of plants; and they ceased to appear when the vegetable broth used as food was abandoned."

"An individual was supposed to be laboring under dysentery from the frequent passage of the yellow pulpy masses in the stools, accompanied with tormina and other symptoms. On examining these masses with the microscope I found them to consist of undigested potato skins. On inquiry it was ascertained that this person had eaten the skins with the potato. On causing these to be removed before dinner, the alarming and other symptoms disappeared."

I mention the following from many similar cases in my own experience. A patient called in great trouble of mind over her distressed condition. As she expressed it "the mucous membrane of the whole alimentary canal was gradually and con-

tinually passing off." The microscope resolved pieces of this "mucous membrane" into the beautiful spiral vessels of the vegetable kingdom. A close questioning revealed the fact that *celery* had formed a large part of the patients diet for a number of days, and the more the patient worried over her "deplorable condition" so much the more celery was eaten "to quiet the nerves."

A patient (with the consent of her physician) sent me what she called "portions of a uterine tumor that came away with the hot water injections." These proved to be shreds of vegetable tissue; perhaps from some vegetable decoction used by the patient without the knowledge of her physician.

A prominent man in a city in this state had been sick for some time with a bladder difficulty. "One morning," he writes, "I passed with my urine a worm which I enclose in a bottle and send to you. I have improved rapidly since and am now about well." The "worm" was about three inches in length, very thin, and about one-eighth of an inch in width. The microscope showed, however, that the animal was simply a longitudinal section of some common straw.

Some vomited matter was sent to me to examine to see if the patient had "cancer of the stomach." The physician writes, "notice especially the hard piece of tissue; I think it is a portion of the tumor." The hard piece was a beautiful specimen of striated muscle, and I jumped at a conclusion by telling the doctor to forbid his patient any longer the luxury of pork.

Fifth,

IN THE DIFFERENTIAL DIAGNOSIS OF THE NEW FORMATIONS.

When it is understood how greatly the different tumors vary as to their degree of malignancy, it is apparent that the microscope will be of value in making a diagnosis, or in giving corroborative testimony to the diagnosis of the surgeon.

In order that the physician may avail himself of some of the practical uses of the microscope as mentioned above, it is not necessary that he should have either thorough training or extended experience. With the aid of some good text-book, well illustrated, he will be able at once to obtain satisfactory results.

In these remarks I have purposely omitted all those points which require more technical knowledge, and more experience in the use of the microscope. I would include under this head the vexatious question of the various "*bacilli;*" of most pathological questions; of questions coming under forensic medicine, and various other matters.

I have also omitted any reference to the delightful recreation this instrument affords with its power to reveal to us the beauties of every insect and plant hidden from the unaided eye of the unappreciative public masses.

Truly did Henry Baker write, a hundred and fifty years ago that "the microscopist never can feel his time hang heavy on his hands, or be weary of himself, for want of knowing how to employ his thoughts; since every animal, flower, fruit or insect, nay, almost every particle of matter affords him an entertainment; each garden or field is to him a cabinet of curiosities everyone of which he longs to examine fully; and he considers the whole universe as a magazine of wonders, which infinite ages are scarce sufficient to contemplate and admire enough."

METHODS OF WORK.

SECOND PAPER.

ALBERT E. JENKINS, ANN ARBOR, MICH.

IN the many advances which have been made in the various departments of scientific investigation in the last few years, scarcely any one branch has received more attention or shown more genuine progress than microscopical studies. From a toy of curious optical properties to the physicist, or a magical glass claiming popular attention as showing suckers on a fly's foot or dreadful creatures in a drop of seemingly innocent water, the microscope has become a means of exact analysis of the widest application. The renditions which have come to us from this source have determined nearly all the conclusions of modern Botany, Zoology, and Physiology. Nor are the biological sciences the only branches of learning indebted to the microscope. Chemistry, Geology, and Mineralogy have put it in requisition and already it has been adapted to these uses.

With this development of the microscope and its applications, many methods of preparations of objects intended for its use have been elaborated, and it will be our purpose in these pages to give the recent and valuable processes of modern investigators.

THE PREPARATION OF ANIMAL TISSUES.

The successful preparation of animal tissues for microscopic study requires great care and a knowledge of the action of the reagents used, for different methods are used in preparing objects to show different characters. The process may be divided into five steps, killing, hardening, embedding and sectioning, staining, and mounting.

Killing.—The tissue is killed so that it shall present the appearance and structure when examined that it had at any desired stage of development or physiological action. This, except where the freezing microtome is used, is done by immersing it in a fluid which destroys the life of the cells. This however is not the only end sought; a fluid to be of value for this work must have the following four properties: It must quickly replace the water or other fluids in the object, it must immediately kill the cells so that no vital action or metastatic alterations go on, it must not induce any structural change, and lastly, its action must not interfere with the subsequent hardening and staining of the specimen. For these ends a number of substances have been employed, and below is given a list of the more valuable ones with the peculiar uses for which each is fitted.

Osmic Acid.—This is purchased in small sealed glass tubes containing one grain of the crystallized acid. This tube may be placed in 100 c. c. of distilled water and broken with a glass rod, the acid quickly dissolving. The one per cent. solution obtained is too strong except for a few tissues. Usually a one-fifth to one-tenth per cent. solution, which can be quickly made by adding one part of the one per cent. solution to four or to nine parts of water, is sufficient. The greatest care should be taken to procure absolutely pure water, as the acid is quickly reduced in the presence of organic matters, and it is well in all cases to keep the bottle containing the stock solutions in a dark

closet, or covered with black paper, as this reduction goes on much more slowly in darkness than in light. These remarks as to the purity of the water employed will also apply to the purity of reagents with which osmic acid may be mixed.

This reagent, alone or in combination, is of the highest value in fixing all delicate protoplasmic structures and cell figures. It stains black all fatty substances, and so is of especial service in studying the secretory action of gland cells, and the nervous system. By its use medullated nerve-fibers can be traced with exceeding ease. Unless carefully used and but for a short time, osmic acid interferes with the after staining, sometimes blackening the entire object treated until it is worthless. This may usually be arrested by immediately tranferring the specimens from the acid to picrocarmime, or a mixture of picro and borax carmines. When it is desirable to black the object preparatory to other treatment, it may be done in the following manner as suggested by Dr. Mayer. The objects are placed in alcohol (seventy per cent. and ninety per cent.) and chlorate of potash in crystals added in quantities slightly exceeding the bulk of the specimens operated on. A few drops of hydrochloric acid or nitric acid are added, and the liberated chlorine gas soon bleaches the object which is then transferred to pure alcohol.

Chromic Acid.—This valuable histological reagent occurs in commerce as red needle-like crystals, which to be sufficiently pure for biological uses, should not contain more than a trace of sulphuric acid. These crystals are very deliquescent, and when exposed to the air quickly absorb water, and undergo various chemical changes. For this reason they should be kept tightly sealed, or as some prefer, a ten per cent. aqueous solution may be made and diluted as required at time of using. In all cases the solution used for killing or hardening should be made of a known percentage of strength, and not judged by the color, a careless procedure which has no excuse.

For merely killing tissues, preparatory to hardening with other reagents, a very weak solution, one-tenth to three-tenths per cent. is employed for a short time, one-half to three hours sufficing, according to the size and nature of the object. For hardening, a one-half to one per cent. may be employed, and as

this fluid has but small penetrating power, it is well to divide the organ into small pieces not more than a one-fourth to one-half inches square, and if a prolonged immersion is required it is well to add a slight amount of carbolic acid, or a small piece of camphor. As chromic acid hardens by a species of tanning, objects become brittle if left in the solution too long. This difficulty may be obviated by a little glycerine, but it is not very desirable as it increases the time required for thorough hardening.

Chromic acid is of almost universal application, it may be used for brain and nerve tissues, lung, the organs of the viscera, decalcifying, etc. It is necessary to thoroughly extract all the acid from the preparation, otherwise the staining will not be permanent, and as the acid is much more soluble in the weaker grades of alcohol, alcohol of 50–60 per cent. should be used and changed often, afterwards increasing the strength to complete the hardening.

Picric Acid.—Picric acid resembles acetic acid in its action more nearly than it does chromic. It comes in straw-yellow crystalline plates which are stable under all ordinary conditions. It is best kept as a saturated solution in pure water, and diluted as circumstances indicate. For fixing the karyokinetic figures of dividing nuclei, the above should be diluted with three or four volumes of water. This reagent is however, chiefly employed in combination, except in decalcifying where it is used full strength. It works better than any other fluid with which I am acquainted in preparing developing teeth for sectioning.

Nitric Acid.—For killing gland tissues, nitric acid of ten per cent. strength may be used, but for embryos, and cell study, it should not exceed three to five per cent. This acid renders the nuclear spindle, the cross striations of muscle fibers, etc., very distinct. In three to four per cent. solutions, the retina of the higher animals is quickly hardened for sections. (Engelmann).

Acetic Acid.—This reagent as a fixative is usually employed in connection with others, though by some it has been very successfully used alone. The most useful form is a one or two per cent. solution obtained by adding one or two parts of glacial

acetic acid to ninety-nine or ninety-eight parts of distilled water. For nuclear study, the cell or tissue may be fixed in the above fluid and then placed in dilute glycerine in a watch crystal so covered as to exclude dust but admit air. Here the specimen should remain until the water has nearly evaporated, at which time the preparation should be mounted in pure glycerine (Dr. E. L. Mark). The evaporation of the water may be accelerated by placing under the cover, calcium chloride, caustic potash, or sulphuric acid which absorbs the water and keeps the air dry.

MIXTURES OF VARIOUS ACIDS.

Osmic—Acetic Acid.—This most excellent medium is prepared as follows:

Osmic Acid,	1 %	aqueous,	10	volumes.
Acetic "	2 "	"	50	"
Water			40	"

As the action of this mixture depends on the nature of the tissue, and the size and thickness of the piece treated, the amount of osmic acid may be varied. If the preparation is too dark and fine details too indistinct, the amount is lessened, if too clear and evidently unaffected, more is added. For blastoderms and nuclear phenomena an immersion of fifteen to thirty minutes is sufficient. The tissue may then be washed in a saline solution and mounted in glycerine, or hardened in alcohol and teased out, or sectioned and mounted in balsam.

Chromic—Acetic Acid.—This is of the highest value in the study of cell life.

Chromic Acid	1 %	,	25	volumes.
Acetic "	2 "		50	"
Water			25	"

This has been employed by Braun for embryos, by O. Hertwig for amphibian eggs and by Flemming for the asters in cell division. When it becomes better known, this fluid will probably be of general value for vertebrate tissues.

Chromo—Osmic—Acetic—Acid.—This is the most elegant reagent which modern histological study has given us. For cell study, Flemming recommends the following mixture:

Osmic Acid	1 %	,	10	volumes.
Chromic "	1 "		25	"
Acetic "	2 "		5	"
Water			60	"

For general histological use, killing all tissues preparatory to further hardening, the following is perhaps a better one:

Osmic Acid 1 %, 2 volumes.
Chromic " 1 " 25 "
Acetic " 2 " 5 "
Water 68 "

The following mixture has been successfully used in studying the ovary, and for the karyokinetic figures:

Picric Acid, saturated aqueous solution, 10 volumes.
Chromic Acid, 1 %, 25 "
Water, 65 "

This is made more energetic by the addition of one volume of a one per cent. solution of osmic acid. This reagent does not interfere with the staining, but as it has small penetrating power, the pieces used should be quite small.

Chromic—Nitric Acid.—(Perengis Fluid).

Nitric Acid, 10 %, 4 volumes.
Alcohol, 3 "
Chromic Acid, 5 %, 3 volumes.

This is of great value for embryological purposes, especially for killing and hardening fish and amphibian eggs. These are allowed to remain in the fluid 4 to 5 hours and then transferred to alcohol until wanted.

Merkel's Fluid.

Chromic Acid, 1:400.
Platinic Chloride, 1:400.

A mixture of equal parts of these fluids has been used for hardening the retina, three to four days being allowed for the action of the fluid. It is also a fluid which will find general use as it becomes better known.

This is a summary of the more valuable fluids which are used for killing, some of them also suffice for hardening, but it is better to employ other means to fit the object for section cutting. In the next article the various methods of hardening and embedding will be considered.

RESOLUTION OF AMPHIPLEURA.

ON a slide prepared by H. H. Chase, M. D., of Geneva, N.Y., with a refractive index of 2.42, I have succeeded in *clearly* resolving A. pellucida with a dry 1-5 in. of 135° air angle. This

was done at my laboratory in the presence of Dr. S. M. Mosgrove and Mr. F. F. Colwell, who bear witness to the same.

Mr. Colwell afterwards succeeded in accomplishing the same result with a *duplicate objective* by the same maker.

This speaks rather well for new mounting mediums and dry 1-5 in. objectives. Does it not? E. F. BECKWITH, M. D.

URBANA, Ohio, May 21st, 1885.

AMERICAN SOCIETY OF MICROSCOPISTS.

EIGHTH ANNUAL MEETING.

H. L. SMITH, GENEVA, N. Y.

THE Eighth Annual Meeting of the Society will be held at Cleveland, O., beginning on Tuesday, August 18th, 1885, lasting four days. Members of the Society will need little urging to attend, for the steadily growing interest in the meetings for seven years is a sufficient guaranty that they will look forward to this one with eager anticipation.

The value of the organization has been established, and we are full of hope and expectation that all the working microscopists of the country will join its membership and make it the center of active microscopical investigation and the means of mutual stimulus to better and higher scientific work. This year's meeting offers some special inducements to attend its sessions.

The arrangements made by the local committees are such as to insure most agreeable and interesting sessions, with the most ample facilities for those who present papers to illustrate them by projection apparatus and otherwise.

The session for illustration of practical work in preparing and mounting objects, which proved so fascinating and useful a feature of the Chicago and Rochester meetings will be still more varied and instructive than before. Mr. C. M. Vorce, of Cleveland, has charge of the preparations for the working session.

The occasion will be one which will naturally call for the best scientific work by our members, and we beg leave to urge that each one will feel a personal responsibility to bring us at

that time the choice products of investigations during the past year.

Each year shows more plainly the importance of having the papers which may be read, so prepared that they may be left with the Secretary at the close of the meeting, and that the publication of the proceedings shall not be delayed by revisions of manuscript, or for the preparation of drawings.

Members are warmly urged to make such use of the blank forms of applications for membership enclosed, as will bring to us as many as possible of those who should be identified with the Society, and increase, while sharing, the advantages of its association. Please notice that the By Laws forbid any action by the Executive Committee upon a nomination, until after the entrance fee ($3.00) and the first annual dues ($2.00) are paid.

Titles and abstracts of papers should be sent as soon as practicable to the Secretary, Prof. D. S. Kellicott, Ph. D., 119 Fourteenth Street, Buffalo, N. Y.; and all who intend to be present, or to join the Society, are requested also to notify him or the Local Committee, Cleveland, O.

HAS THE NUMBER OF BACTERIA NO LIMIT?

C. H. STOWELL.

MR. J. D. Beck, of Liberty, Pa., sends a communication to this journal on the above subject. From it we take the following figures as computed by him: Mr. Beck finds a large number of bacteria in the sap from the sugar maple, "at least 500 in the field at one time." He estimates from this that there are 125,000,000 in a drop of the sap, and in a common goblet full, holding 3,000 drops, as many as 375,000,000,000. He further estimates that in the 500 gallons of sap boiled down by some farmers in a single day there are as many as 3,000,000,000,000,000. Thus he proceeds; but while it is remembered that any slight variation in the number first chosen makes a vast difference at last in the sum total, it is doubtful if any value can be attached to such figures, more than would come from the mental drill in computing the various amounts. It is of the same value that arises from computing the number of cod-fish there would be at the present time, if all the eggs should become fish, starting with a single fish *only ten years*

ago. Naturalists say that this fish spawns 3,000,000 eggs in a single season. Starting with this as a basis we proceed, and we find that at the end of ten years the number of fish would amount to 214,449,000,000,000

THE ANNUAL MEETING AT CLEVELAND.

E. H. GRIFFITH.

IT has been my good fortune within the past few weeks to visit a large percentage of the members of the American Society of Microscopists, also other good workers, at their homes. Commercial pursuits in many of the larger cities of the States have frequently given me this privilege for years, and it is a pleasure to be able to report a constantly increasing interest in microscopical research and a large addition to the army of microscopists. New societies are being organized; new fields of investigation are being opened; new discoveries are being made; and it is probable that more real advancement in microscopical research in America has been made since the organization of our Society than for the entire century previous. Our eighth annual meeting, to be held in Cleveland in August, bids fair to be better attended and more practical than any previous. There are many earnest working microscopists who have attended each meeting of the Society, who now look forward to these annual gatherings with intense interest. One by one of our members are leaving our ranks, however, and joining those who see face to face, and not through a glass darkly. We miss them greatly, but we welcome those who remain; also new recruits to our numbers. Cleveland is a beautiful city, and in it are found earnest workers who will welcome us with great cordiality. Then let us enjoy their hospitality and improve a golden opportunity.

THE MERITS OF WHITE ZINC CEMENT.

W. H. WALMSLEY, OF PHILADELPHIA.

I HAVE noticed of late your many references to the merits of White Zinc Cement, especially those in the May number of THE MICROSCOPE, referring to Cole's slides finished with it. I may mention as an item in this connection, that in 1871 I sent by the hands of a friend then going abroad a dozen of my double stained vegetable sections, finished in white zinc, with a blue line, (such as I first used in 1867), to Mr. Cole. In due course an acknowledgement arrived from him speaking enthusiastically of the appearance of this finish, and asking for some of the

cement, of which I sent him a dozen bottles, and subsequently more than a gross of them. For some years now, however, he has made his own, from my formula. I have many slides now in my cabinet of fluid mounts made with this cement from 1867 to 1871 which have never been touched since, and are "good as new."

EDITORIAL NOTES.

LONG PAPERS VS. SHORT PAPERS.—It is difficult to imagine anything more trying than to listen to a long paper read in a crowded room on a warm day, especially if the subject is one in which we are not interested. The speaker may be gifted and the article may be a valuable contribution, yet the result will be the same.

We are of the opinion that a paper should never be read, before a society, of more than twenty minutes in length. Whole treatises on unusual subjects should not be inflicted upon the suffering and defenseless members. If any person has a longer paper than indicated above, which the publishing committee think worthy of publication, then let us have only an abstract of it at the public meetings. Our verbose author will reply that this abstract will not allow the subject to be presented full enough to permit of free discussion at its close; in reply to which we ask, did you ever hear a paper discussed that had occupied an hour in its reading? The truth is the members are so tired at the end of the hour that their only desire is to again breathe plenty of fresh air.

The conclusion of the above matter is that the executive committee should authorize the secretary of the American Association to notify all parties intending to present papers at the Cleveland meeting that, first: No author shall occupy more than *twenty minutes* in reading his paper; second, no paper should be read *by title* only; third, papers more than twenty minutes in length should be read *in abstract;* and fourth, discussions should be limited to ten minutes in length. Short papers, short speeches, and short sessions, will give the members more of an opportunity for social intercourse and comparison of notes, and will insure a successful meeting.

WHITE ZINC AGAIN.—There is no man in this country more competent to speak of the value of White Zinc as a mounting medium than Mr. Walmsley, of Philadelphia. In the first place Mr. Walmsley experimented a great deal with White Zinc, and as a result finally gave us his well-known cement; and in the second place he has had the opportunity of watching its durability as no one else could. He has had thousands of mounts finished with this cement right before him for years, and his testimony should be taken as a conclusion of the whole matter. Mr. Walmsley simply states a truth, but in so doing he gives a scathing rebuke to that class of people who are happiest when deteriorating the works and opinions of others.

Mr. E. E. Jackson, of Columbia, S. C., writes that he has a number of mounts finished with White Zinc by Mary A. Booth, and "they are neat and solid, unchanged by travel or time."

We have just been able to procure some missing numbers of the Journal of the Royal Microscopical Society, which makes our set complete from the first number to the present time. To our collection of old books on Microscopy we have recently added "Marcelli Malpighi. Opera omnia. 1687."

That "pride goeth before a fall" is well illustrated by the fact that while the above personal item on our special library partakes of the "pride", this item includes the "fall"; for Prof. A. Y. Moore tells us of some errors in the proof-reading of his article in our May number that need correcting. Page 102, line 4, should read, "Two of these are made of crown glass *and the others of flint glass*," etc. Page 106, line 9, the word "pressure" should read *presence*.

If you noticed a blue pencil mark on the wrapper of your journal, it is a gentle hint that we would gladly receive a dollar from you for 1885. Please send us your renewals as soon as possible.

"Among the elections were those of the lady fellows, the first under the new by-law, one of them being the joint editor of a Microscopical Journal well known in America and this country."—*Royal Mic. Journal, for April.*

SELECTIONS.

THE STAINING OF BACTERIA FOR MICRO-PHOTOGRAPHIC PURPOSES.

BY EDGAR THURSTON,

CURATOR OF THE ANATOMICAL MUSEUM, KINGS COLLEGE, LONDON.

By means of micro-photography, very faithful representations of the form and general grouping of bacteria can be reproduced, such as it is exceedingly difficult to delineate in a drawing, however artistically it may be executed. At the hands of only a few men has, however, the photographing of bacteria been really successful, and one too frequently sees the organisms represented as faint, indistinct bodies with ill-defined outline, and surrounded by a hazy zone, the first fault being due to unskilled execution of the staining processes, and the second to the employment of indifferent objectives and bad illumination of the object; on both which points special care must be bestowed, as nearly all bacteria require for their investigation high-power objectives.

Micro-photography, in its application to bacteria, must be dealt with under two headings: 1st, the preparation of the bacteria by suitable staining methods; 2nd, the process of photographing them; and I propose on the present occasion to deal with only the former.

It may be required to photograph bacteria under two distinct conditions, according as they are present—1, in the free state or in fluids; 2, in the organs and tissues of the animal body; and for each of these conditions a special mode of preparation must be adopted.

As examples of bacteria occurring in a free state, or in fluids, I may take, from among many, the various colored (chromalogenous) species of which colonies grow on the surface of eggs, meat, bread or potatoes; the putrefactive bacteria in decaying meat or vegetable infusions; the sputum (expectorated matter) from the lungs of a pneumonic or tuberculous person; or the blood of an animal suffering from splenic fever.

To stain such bacteria the following mode of procedure will be found the best: Place a minute portion of the bacterial fluid,

or of a bacterial colony, by means of a previously heated platinum needle, on the center of two cover-glasses (.004-.005), and, laying one cover-glass over the other, squeeze them gently together between the fingers, so that the bacteria are diffused over their surface in a uniform layer. Then slip them apart and leave them to dry. After a few minutes, pass the cover-glasses rapidly through the flame of a spirit lamp, so as to fix the bacteria on the glass. Cover-glasses so charged may be kept for an indefinite time; and if an interesting growth of bacteria is met with, it is always well to preserve some specimens in this way for future reference.

For all practical purposes it may be said that bacteria of which micro-photographs are to be taken must be stained with a red or brown dye, and by far the best medium is a saturated watery solution of vesuvine or Bismarck brown, which should be filtered before use. For precise work, it is always best to use a freshly-made solution, inasmuch as bacteria, torulæ, and fungi develop in it after it has been made some time, and their presence may give rise to an erroneous observation.

The cover-glass, with the bacterial surface downwards, should be floated on the top of the solution, and allowed to remain there for approximately an hour, though experience will show that the time required will vary according to the specimen of dye which is used. It is then removed from the solution, washed in water, and afterwards in a half or one per cent. solution of acetic acid, and allowed to dry—or, if time is an object, pressed between folds of blotting paper—and its surface brushed with a camel-hair brush to free it from particles of dust, etc. It is then mounted in Canada balsam, and is ready for microscopical examination. The best form of balsam for mounting bacteria is that which is dissolved in xylol, which is very easy to work with, and does not abstract the dye from the bacteria. If the slide is to be examined with an oil immersion objective, the edge of the cover-glass should be sealed, when the balsam is dry, with Hollis' glue. If the various stages of the staining process have been properly carried out, the bacteria should appear deeply stained and sharply defined.

Turning next to a consideration of bacteria as they occur in the organs and tissues of the body, I may cite, as examples, the

various infective diseases of man and the lower animals. The organs must first be hardened by one of the numerous hardening processes, of which the one I generally adopt myself is to place the organ, or a selected portion of it, for forty-eight hours in dilute methylated spirit (1-2), and then transfer it to pure methylated spirit, in which it may be kept for an indefinite time. When it is sufficiently hardened, sections must be made by hand, or with one of the microtomes. For photographic purposes the sections should be cut as thin as possible, for with thick sections a fogged picture will result. A perfect section, but one rarely met with, would be one which is of the thickness of a single cell throughout.

To stain the sections, they are placed in the saturated watery solution of vesuvine or Bismarck brown, and allowed to remain there about an hour, then washed with distilled water, and afterwards in a half to one per cent. solution of acetic acid, dehydrated in absolute alcohol, clarified in oil of cloves, and mounted, with Canada balsam in xylol. The bacteria should appear as deeply stained bodies standing out in bold contrast with the diffusely and more lightly stained tissue elements. The specimen should be covered with an extra thin cover-glass (.004-.005), for, if a thicker cover-glass is employed, a high-power objective may not be capable of working through it. The thickness of the cover-glass can be easily gauged by Elliott's gauging machine.

The staining of bacteria, whether on the cover-glass or in sections, will be found, with a little care and practice, perfectly easy. The only difficulty is to hit off a mean between understaining and overstaining, so that the bacteria are neither too faintly nor too deeply stained; but this is easily overcome.—*Photographic News.*

"Dr. Stowell's journal is always a welcome guest. The journal has steadily increased in value with time. I trust that every well regulated knight of the tube feels as I do—that it would be very poor economy indeed to do without this journal.—*J. O. Stillson, M. D.*

REVIEWS.

PARADISE FOUND. The cradle of the human race at the North Pole. By William F. Warren, S. T. D., LL. D. President of Boston University. 12 mo., pp. 500. Illustrated. $1.50. Second Edition. Houghton, Mifflin & Co., Boston. 1885.

The first thought that naturally comes to the reader of the above startling announcement is that the book must either be the work of a dreamer or a cunningly devised fable. A careful reading of the work, however, will show that the author makes a sincere and serious attempt to solve one of the most fascinating of all problems. That it is an important problem also is well understood when it occurs to us that the historian, the archæologist, the ethnologist, the philologist, and the theologian must all work in the dark until the starting-point of human history can be determined. But to locate the starting point at the North Pole seems at first to be the wildest of speculations. Yet the author is willing to let the whole theory rest upon the solid facts as they are presented, and he submits the question to the following proofs:

1. *General geogony*, or the science of the origin of the earth:

2. *Mathematical* or *astronomical geography*, particularly its teachings as to the inhabitableness or uninhabitableness of the circumpolar region with respect to light:

3. *Physiographical geology*, particularly its teachings as to the probability or improbability of the former existence and subsequent submersion of a circumpolar country: 4. *Prehistoric climatology*, particularly with reference to the temperature at the pole at the time of the beginning of human history: 5. *Paleontological Botany;* 6, *Paleontological Zoology;* 7, *Paleological Amthropology and Ethnology ;* and 8, *Comparative Mythology.*

This eight-fold test is presented, and met with such a mass of facts that the reader is obliged to say at the very least that the verification is much more complete than is usual in matters of prehistoric research. It is a work that will attract the widest attention, and can be read with interest and profit by all. The question is, "Was the cradle of the human race, the Eden of primitive tradition, situated at the North Pole, in a country submerged at the time of the Deluge"?

TENANTS OF AN OLD FARM. By Henry C. McCook, D. D. Small 4to., pp. 460. Illustrated. Price, in decorated cloth binding, $2.50. Fords, Howard and Hulbert, New York. Second edition. 1885.

The first edition of this charming book was exhausted in three weeks, and in response to a decided call the second edition has just been placed on the market. The work is profusely illustrated, including many comical characterizations of insect life, by Dan C. Beard. It gives us a delightful series of excursions and investigations into the habits of bees, ants, spiders, and all sorts of insects. The author gives us the latest scientific researches, with the curious and interesting, in the most enthusiastic and pleasing manner. All the sorts and conditions which can be found on an old farm are set forth with clearness and simplicity. In an easy, and many times amusing conversational style, he tells of odd superstitions about insects, and the part these little creatures play in the economy of the animal and vegetable world. It combines pleasure and instruction to an unusual degree.

LIFE AND TRAVELS IN INDIA. Being recollections of a journey before the days of railroads. By Anna H. Leonowens. Small 4to., pp. 325. Price, in decorated cloth binding, $2.00. Porter and Coates, Philadelphia. 1885.

The author gives us a very faithful account of her life and travels in India before the country was in any way modified by the introduction of the railroad. Still we are told that even the railroad has in no sense affected the life of the people, and that India remains to-day, what it was in the Vèdic period, a land of peasant classes.

Some most amusing glimpses are given of the author's housekeeping experiences, together with pictures of the inner life and social condition of the various races now found in Hindoostan.

All the sketches are written on the spot, from actual observation, and thus they give a new and fresh interest in India and her people.

The author has great descriptive powers, and one sees readily all of the out-of-the-way places she visits.

Great hopes are entertained for the future of India, under the liberal policy of England, "as glorious a future as her bril-

liant youth and maturity have foreshadowed for her." It is not only a pleasant book of travel, but also valuable from its descriptions of the religious and historical development of the Aryan race.

A DESCRIPTION OF THE GRASSES OF THE UNITED STATES. By Dr. George Vasey. pp. 150, 120 plates. Government Printing Office. 1885.

A STUDY OF THE PARLIAMENT OF PARIS, AND THE OTHER PARLIAMENTS OF FRANCE. By Jane M. Bancroft, Ph. D. Professor in the Northwestern University, at Evanston, Ill.

Historians are aware of the fact that the subject of the Parliaments of France is treated by no one English author; hence this author has rendered a valuable addition to historical literature in giving their origin, organization and political history. The translations necessary to complete such a study were both numerous and difficult, and the author is to be highly congratulated for the clear, concise and philosophical presentation of the subject. The work has met with the most flattering reception from all the prominent Professors of History in this country, as well as from many abroad.

FERMENTATION IN THE HUMAN MOUTH. By Dr. W. D. Miller, Berlin, Germany. Reprint from the Independent Practitioner. pp. 40. 1885.

BACTERIAL PATHOLOGY. Reprinted from the London Lancet. Price 25 cents. Illustrated with 30 engravings, showing the appearance of the bacteria, and the apparatus used in preparing and cultivating them. The Industrial Publication Co., New York. 1885.

THE CENTURY.

The June number starts with an edition of 250 copies, and is well filled with its usual choice collection of literature, together with articles in its "War Series." Among the latter are, "The Battle of Gaines Mill," and "Stonewall Jackson in the Shenandoah."

MICRO-CHEMISTRY OF POISONS. By T. G. Wormley.

In a review of this work on page 116 of our May number, we said "the purpose of the author has been to prevent the study," etc., while we intended to say his purpose was to *present* the study, etc. A single letter made considerable difference in our meaning.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

FOR EXCHANGE—Mammoth Atlas of Human Anatomy, 45 parts, unbound, by Drs. Vesterreigher and Erdl. Cost me $33.75. Will exchange for $20 worth of aeeessories or objectives.
DR. C. H. LOVEWELL, Englewood, Ill.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED to cxenange a Seiler's seetion knife earrier (new) for a good mierotome or turn-tablc.
J. T. WAID, M. D., Ridgway, Pa.

WANTED—Microscope stand and microscopical books and journals. Will give various artieles or cash for same, Send for list. C. VON EIFF, Jr. 347 Greenwieh St., New York City.

WOULD like to exchange a 1-6 in. object, drv, 160° for a first-class microtome.
J. B. JENNINGS, 78 Mayor block, Chicago, Ill.

WANTED.—One second-hand turn table ; also one second-hand section eutter for soft material; also one second-hand micro-dictionary. Above must be very low priced and in fair order. Send description of style and cost to E. S. COUTANT, 1022 Woodland ave., Des Moines, Iowa.

WILL EXCHANGE OBJECTIVE.—An adjustable Nachet 1-9 (dry)—society serew, with *very long* working distance—has moderate angle. Correspondence solicited.
E. T. BECKWITH, M. D., Urbana, Ohio.

TO EXCHANGE—Pulvermacher chain battery (100 elements) for applying electricity to thebody —cost $30 for cheap microscope stand, slides, minerals or lantern slides.
J. CROWTHER, 320 Pleasant St., Fall River, Mass.

FOR EXCHANGE—A good refracting telescope 2¼ in. operturc which will resolve Epsilon Lyra with half inch eye piece—value $65, will exchange for a first-class Bausch & Lomb objective.
J. E, WHITNEY, Rochester, N. Y.

WANTED.—Diatoms on Algæ or in muds from all the tropieal sea shores, cspccially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg. Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

WILL cxchange mounted slides of various minerals (native crystals), and others, for well mounted slides. WILL H. OLMSTED, Syracuse, N. Y.

EXCHANGE.—Parties having diatomaceous earths or other microscopical material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow. Msss.

QUEEN'S New Sub-Stage Condenser. with dividing combination for high or low powers, and three Caps, for sale or exchange. DR. A. C. STOKES, Trenton, N. J.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FRESH-WATER ALGÆ, ncarly all gencra, and many beautiful varieties; also Euglena, Astasia, etc., for good pathological or other interesting slides. Lists exchanged.
J. M. ADAMS, Watertown, N. Y.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

HISTOLOGICAL SLIDES, very thin and evenly cut, well mounted and well ringed, will be exchanged for Pathological or Histological slides only.
H. L. WHITNEY, M.D., German Hospital, Philadelphia, Pa.

PLEASE announcc that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

FOR SALE.—Slides, double stained, of Bacillus Tuberculosis, 50c. each.
DR. W. R. CHITTICK, 83 Lafayette Avenuc, Detroit, Mich.

WANTED.—Books treating on microscopical and histological subjects not already in my possession. Will pay cash, or give slides in exchange. State name of the work, date of issue, and priee. C. H. STOWELL, Ann Arbor, Mich.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M. D., Geneva, N. Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

PATHOLOGICAL, Histological, and other well mounted slides will be exchanged for mounted specimens of intcrest. Lists furnished on application.
D. E. HAAG, M.D,, Liberty Center, Henry County, Ohio.

THE MICROSCOPE.

VOL. V. ANN ARBOR, JULY, 1885. No. 7.

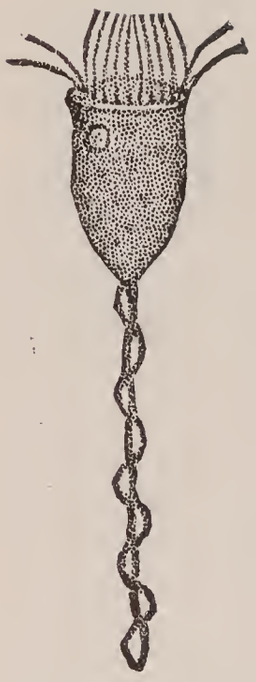
ORIGINAL COMMUNICATIONS.

VORTICELLA LIMNETIS (*Species nova*).

BY DR. ALFRED C. STOKES.

THE following description of a previously unobserved form of Vorticella relates to a species obtained in some abundance on Utricularia from the cedar swamps of the New Jersey pine barrens, where the water is so richly colored by the so-called humic acid that the observer is led to expect that the microscopic inhabitants will be equally well tinted. But such is not the case. The Choano-Flagellata retain their distinctive greenish hue, Infusoria common also in other localities possess their ordinary coloration, and the Vorticella here referred to has the usual pale or colorless aspect of the group. This is an interesting and suggestive fact.

The present form is remarkable for the peculiar twisted appearance of the sheath of the pedicle, a characteristic which it has in common with *V. octava*, described by the writer in "The Annals and Magazine of Natural History" for June, 1885. But aside from another and more valuable specific character, that of its smooth cuticular surface, it is easily distinguished from *V. octava* by the much smaller body, and the greater abundance of the spirals and the consequent shortness of their curves. The sheath appears to be conspicuously thickened on one margin, and to be thrown into these spiral convolutions because it is too long for the enclosed muscular thread, the latter when extended not being able to entirely straighten it as in most of the other species, the opposite, thinner border at all times clinging to the muscular thread so that it is commonly invisible. The following is the description referred to above:



V. limentis, sp. nov. (Fig. 1). Body smooth, conical-campanulate, widest anteriorly, less than twice as long as broad, constricted beneath the peristome which exceeds the body center in width, is everted and slightly revolute; ciliary disc elevated, rounded; endoplasm colorless, granular; pedicle six or seven times as long as the body, the sheath apparently twisted. Length of Body 1-425 to 1-450 inch. Habitat—On Utricularia in the cedar swamps of the New Jersey pine barrens. Solitary.

To include this in the Key to the Vorticellæ published in the MICROSCOPE for May, 1885, the following should be inserted in § § § immediately after *V. dubia*, From

§ § § Conical-campanulate; border not undulate; pedicle 6 to 7 times as long as the body, the sheath apparently twisted. *V. limnetis.*

GLEANINGS FROM THE JOURNAL OF THE ROYAL MICROSCOPICAL SOCIETY FOR APRIL.

C. H. STOWELL.

COST *of Objectives of large aperture.* The great increase in the labor necessary to produce an objective of large aperture is but little understood or appreciated. For instance, a 1-6 inch of 1.50 N. A. costs about $175. Yet this journal remarks that, high as this price seems, "it does not represent more than a very moderate return for the skill which the construction of such an objective requires."

Monoculars vs. Binoculars. A writer in the English Mech. says that the great majority of men who use the microscope as a tool and not as a plaything, look upon the English craze for binoculars and complicated stages and accessories as sheer waste of time.

Remarkable fungoid growth. A small fragment of mucus from the stomach of a mad dog was placed in water. The fluid contained pepsin and possessed all the properties of the gastric

juice. Nevertheless there was the most remarkable growth of *aspergillus niger*, while small quantities of albumen placed in the water were dissolved, the fungus was not attacked by the pepsin in the least, "a fresh proof of the fact that a pronounced difference must exist, of a chemical nature, between living protoplasm and ordinary albumen."

Vitality of germs. A recent French writer has been experimenting to determine whether germs preserved damp would, like those preserved in the dry state, and sheltered from solar light, resist for several years the action of temperatures higher than those of the hottest parts of the world. The author used infusions made by Pasteur in 1875 and 1876, and also in a few cases infusions were used prepared in 1859 and 1860. All the infusions in which living germs were found had the liquid still slightly alkaline, while those in which they were dead were acid. "Of the 65 infusions opened, fifteen contained living germs, and that after a period of twenty to twenty-five years.

Pneumonia cocci in Dormitories. Emmerlich states that he has examined material obtained from the sleeping apartments of patients with pneumonia, cultivated it in gelatine and injected it into rabbits, mice, etc., which soon died. In their blood he found the characteristic septic organisms identical with the bacilli of pneumonia.

The MICROSCOPE for May is also to hand, and is, as usual, full of information of value to the working microscopist. Dr. A. C. Stokes has a most excellent illustrated article entitled "A Key to the Vorticellæ," being a scheme for the rapid identification of members of this group. Dr. Allen Y. Moore has an article, also illustrated, on the microspectroscope, and Professor ——— gives us the fourth number of his series on embryology. The paper alone is worth to the student ten times the annual cost of The MICROSCOPE.—*F. L. James, in The National Druggist.*

We desire to call particular attention to Mr. Vorce's appeal for help. Let every practical worker come to the rescue at once. Please notice also the circular he presents on the page following our "Exchanges."

SOME OBSERVATIONS ON THE DISTRIBUTION AND TERMINATION OF NERVES IN THE HUMAN LUNGS.

BY EDWIN F. BECKWITH, M. D., URBANA, OHIO.

IN the following observations the lungs of several human adults were obtained fresh from the post-mortem table, great care being taken in procuring the lungs of subjects the autopsis cadaveris of whom had been conducted within a very short time after death.

Aware of the futility of hoping to obtain good results from any known cause of preparation and staining of the nerves of the lungs, it was found necessary to seek a new method,—and after months of hard work, with many miserable failures, the following, a modification of a process lately promulgated in Germany for staining brain tissues, was found to answer. Harden fresh lung for about ten days in the following solution:

Bichromate of Potash 2.5% to which is added Sulphate of Copper C. P. to the amount of 0.5%. The tissue is then frozen in microtomes and suitable sections made, which are treated with—

Gold Chloride 0.5%—2 to 10 minutes in the dark.
Washed through distilled water.
Sodium Hydrate 1 to 5 — until *cleared up*.
Potassium Carbonate 10.% — 30 to 60 minutes.
Dried with absorbent paper.
Potassium Iodide 10.%—15 minutes, when gold will be nicely reduced.

The nerves and ganglia in sections thus prepared are of a *deep red* or violet color, occasionally shading off into a bluish green, the other tissue being red. The differentiation in color is sharp, so that nerve tissue may be recognized by its color alone whenever seen.

The above described method of preparation differs very little from the German process, with the exception of the Potassium Carbonate, which I believe *essential* to success; as in my hands, the *unmodified* process failed to give good results, when used on lung tissue. A great advantage of this method consists in the fact that the reduction of gold always takes place in a uniformly even manner; and with little practice, perfect staining can be accomplished with every section.

Unfortunately, as in other gold preparations, these specimens spoil in a short time unless preserved in the dark in 40% alcohol, and when examined should be temporarily mounted in glycerine.

By careful observation all the following may be made out:

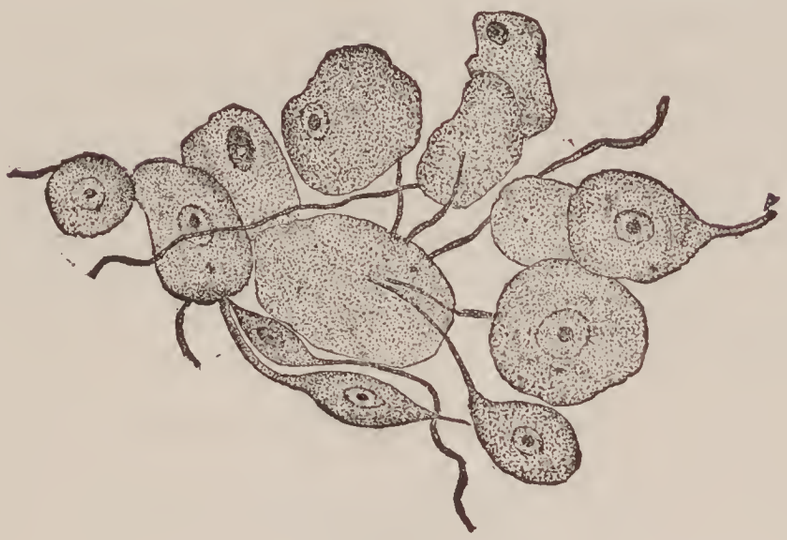


Fig. 1.

1st. The lung is richly supplied with ganglionic cells; abounding everywhere, but more especially in the alveoli.

2d. There are ganglia composed of numerous cells, some of which have but one process, fig. 1: these ganglia are often found occupying an alveolus.

3d. There can be seen projecting into the alveoli large unipolar ganglionic cells, fig. 2, A.: one or more cells of like character can be found in nearly every alveolus.

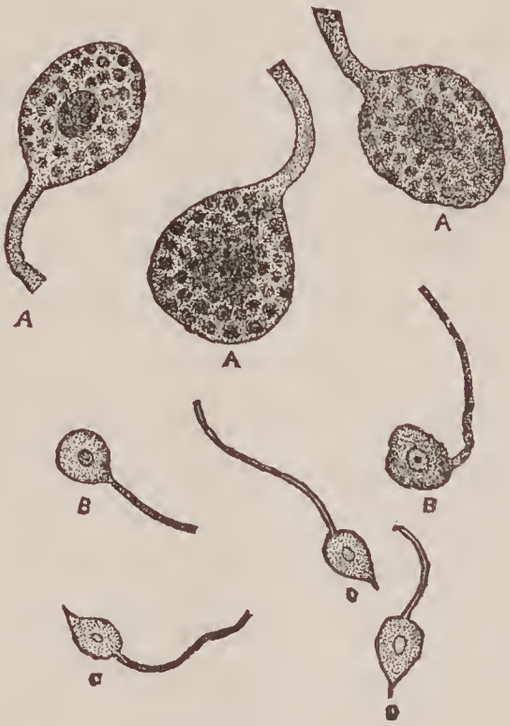


Fig. 2.

4th. In many localities, out of the alveoli, can be found numbers of smaller unipolar cells, fig. 2, B.

5th. Other smaller unipolar cells are seen which have pointed extremities, fig. 2, C.

6th. The nerve-fibres are found in great abundance passing from ganglion to ganglion, forming a network; the larger fibres in most instances coursing along the vessels and fibrous trabeculæ, and by following up the smaller fibres, there will be found in the course of some nerves, small fusiform cells, having distinct nuclei, fig. 3, A.

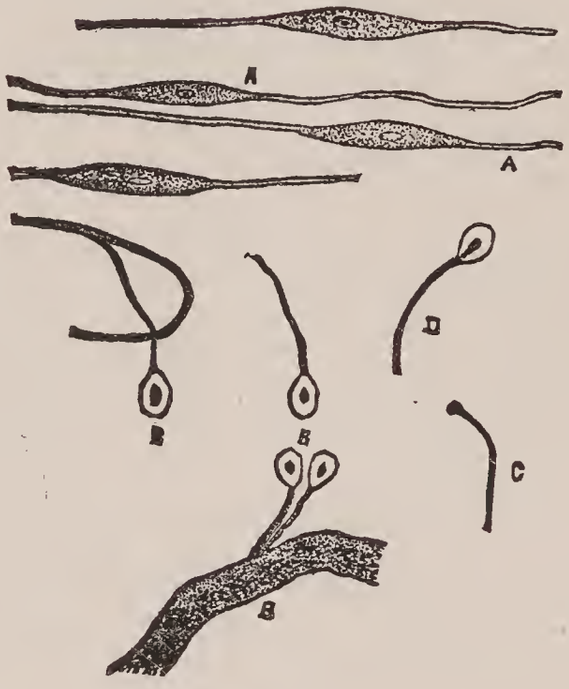


Fig. 3.

7th. In the bronchi and alveoli, but more frequently in the alveoli, are minute terminal bulbs or extremities which are more or less pear-shaped, and distinctly nucleated; the nucleus always in the same relative position, fig. 3, B, and of the same color as the nerve, the protoplasm or material outside the nucleus is not always so colored, appearing very often much lighter; and in a great many cases, owing, as I believe, to a similarity in refractive index with surrounding tissues, the protoplasm or material which immediately envelopes the nucleus is invisible, when the termination appears as represented in fig. 3, C. I have a few times seen the nerve-fibres in *distinct connection and continuous* with the nucleus of an end-organ, the substance surrounding the nucleus being also visible, fig. 3, D.

As to whether some of the larger unipolar cells should also be regarded as nerve terminations I do not know, certain it is, that considering their situation, it seems as though some

of them should be so considered; but be this as it may, I think it best to leave this question for future investigation.

Seven out of the twenty-five hours for many months were devoted to the pursuit of this subject, a very large number of slides being carefully examined with the following objectives, together with a first-class substage condenser:

Bausch & Lomb Optical Co.	3-4 in.
Bausch & Lomb Optical Co.	1-5 in.
Beck	1-8 in.
Nachet No. 5	1 9 in.
C. A. Spencer, Im	1-12 in.
Bausch & Lomb Optical Co., H. I	1-12 in., N. A. 1.43.
Zeiss, H. I	1-12 in.
Hartnack Im. No. 10	1-16 in.
Tolles—dry	1-30 in.

The terminals can be seen with a *good* 1-5 inch objective; but my most satisfactory views were obtained with the Bausch & Lomb H. I. 1-12.

As the drawings illustrating this subject are necessarily incomplete, and fail to represent many forms of ganglionic cells, and also, as some may be disposed to *question*, I would say that I have a number of photo-micrographs illustrating this subject which I shall be pleased to send any one for inspection, as verifying my statements. Heretofore I have felt much hesitancy about publishing the results of my observations, but having, with a new Gundlach Optical Co.'s 1-30 N. A. 1.25, made to my order for this especial purpose, succeeded in securing several good negatives, I am in a position to demonstrate in a great measure my assertions, to those who from lack of time, or inclination, fail to investigate the subject for themselves.

In making the photo-micrographs I am greatly indebted to my friend Dr. S. M. Mosgrove for his kind assistance and coöperation, for which I wish to express my hearty thanks, and also to my friend and former preceptor, Dr. Starling Loving, of Columbus, Ohio, for many kind words of encouragement, while I have been at work on this subject, and last but not least, to my friend Dr. A. E. Bleile, of Columbus, Ohio, to whose suggestion is due the fact of my having ever undertaken the study of this special subject. It may not be out of place to

draw attention to the analogy existing between the results obtained by Dr. Bleile on the lung of the salamander so far as his investigations go, with those here given.

Finally, I wish to hazard the opinion that the method of preparation here given will be found of value, as I believe nervous tissue can in this manner be differentiated in any of the organs of the body.

THE WORKING SESSION.

A WORD TO THE WORKING MICROSCOPISTS.

BY C. M. VORCE, CLEVELAND, OHIO.

THE preparations for the Eighth Annual Meeting of the American Society of Microscopists, to be held in this city Aug. 18–21, 1885, are well under way, and will be, it is hoped, very complete. The labor of these preparations has fallen largely to my share, and with the general work, that of the Soiree and the Working Session added to my regular professional work, will make my own personal "working session" cover a continuous period of three months, almost night and day. Foreseeing this, to some extent, I published in THE MICROSCOPE for February, 1885, the scheme of work adopted, and the coöperation of the working microscopists of the country in carrying it out. In that communication I solicited offers of aid in the Working Session, but to my sorrow I am compelled to say that my appeal seems to have fallen upon heedless or indifferent ears, for to this time I have not received a single offer of assistance in response to that call!

"Call you this backing your friends?"

In response to personal letters a goodly number of expert demonstrators have been secured for the Working Session, but some subjects of the scheme of work still remain unfilled, and there is ample opportunity for the further illustration of the subjects assigned by means of different methods, new apparatus, new processes, etc. It will be impossible for me to take the necessary time to write directly to all those whose services in the Working Session I wish to secure, and therefore I now repeat my appeal to all microscopists who are willing to serve their society and their fellow members, and be of benefit to the cause

of microscopical science, that they now come forward and show their good will.

Write to me what subject you will be willing to demonstrate, what apparatus you will exhibit, what processes and methods you will explain, what arrangements you will need to have provided for your work, etc., etc. Also send me the names and address of all those you know to be expert in photo-micrography or micro-photography, and the names and officers of all microscopical or scientific societies in your neighborhood. You can do this in a few minutes of time and with but a trifle of labor to each of you—for me to do it all will require weeks of incessant labor, and I am already about worn out. "Help me, Cassius, or I sink!"

Reader, I mean YOU.

Through some mistake the half page advertisement of "The Bistoury" was dropped from our last two issues. Yet Dr. Up de Graff keeps right on adding to his long list of subscribers. If you do not know what a good journal a man can publish for fifty cents a year, just send that amount to the doctor's address at Elmira, and find out.

We are in receipt of six as handsome slides as are found anywhere. The specimens themselves are beautiful, especially the transverse section of Virgin's Bower, while the finish of White Zinc is superb. They come from R. K. Pearce, 5219 Pear st., Philadelphia.

The price of the London Medical Student is $2, and the price of our Histology is $3.50. We will mail both to any of our subscribers and give them credit for a year's subscription to this journal,—in all $6.50 worth of reading matter—upon receipt of $5. This offer is open only for one month. If you have renewed for 1885, then we will credit you for 1886.

SELECTIONS.

MANUAL OF HISTOLOGY.

BY C. H. STOWELL, ANN ARBOR.

Among the various new text-books in microscopy and histology, which have appeared during the past five years, few have met with such successful recognition as Prof. Stowell's book.

Appearing first in 1881, it has now, within three, years attained its third edition, which of itself is sufficient evidence of its merit. This book is designed to meet the wants of a certain class of workers and students, who require a *reliable* guide, sufficiently practical for every day use, well up to the mark of what is recognized as authoritative in matters of science, and at the same time condensed within such limits as to make it a ready book for reference, and of such moderate cost as to commend itself to the favor of all.

It has been my good fortune to have access to quite a number of the best works on these subjects for several years past, and I can hardly describe the pleasure I experienced on my first perusal of this book compared to others. As amateurs we are all prone to fall into the same errors in the beginning, one of the most usual of which is to imagine that a manual must necessarily be a large book in order to be complete. This manual is free from the one objection common to many such works which are really cumbersome, containing the ideas we are most in search of, hidden in voluminous text insufficiently indexed, and requiring a great amount of reading on the part of the student to find the hints he may be seeking. While Prof. Stowell's book is an octavo of nearly 400 pages, its chapters are condensed, in well written language of pleasing style, and well illustrated with 178 engravings.

After a general introduction and discussion of the optical features of the microscope, he enters upon the description of

METHODS FOR PREPARING MICROSCOPIC OBJECTS.

Giving the various formulæ for injecting mixtures, hardening, softening, dissociating and normal fluids, hardening reagents for tissues, section cutting, and embedding mixtures, staining,

preserving, and mounting media, with instructions how to prepare animals for injection and physiological study. His chapters on biology deal with the amœba and the cell, the morpological elements of the body, the blood, its physical and microscopical characters, its medico-legal importance, with rules as to the detection and differentiation of blood stains, the counting and measuring of blood corpuscles, after which follows the normal histological study of the various tissues, *i. e.* epithelium, connective tissue, muscle, bone, teeth, adipose, glandular, nervous, vascular and other structures.

The book concludes with a description of the various kinds of tumors most usually found. It tells how to preserve them; what kind of media are best suited for the various growths; how to classify them; their origin; formation types; and methods of examination with the microscope. Altogether the book is what it claims to be, a Student's Manual, and has about it the "chalk marks" of a teacher who knows how to handle his class. —*J. O. Stillson, in the Indiana Pharmacist.*

COLLEGE ALUMNÆ ASSOCIATION.

The May meeting of the Western Association of Collegiate Alumnæ was held at the Art Institute Building yesterday. At the business session three measures of importance were considered: The organization of local committees in Rockford, Ann Arbor, and Milwaukee; the formation of a Teachers' Bureau, to provide situations for members of the association desiring to teach; and a memorial to be sent to Johns Hopkins University asking for the admission of women to post-graduate courses. The literary exercises of the afternoon were both profitable and interesting. Mrs. Louisa Reed Stowell, of the University of Michigan, made an address on "The

ADVANTAGES OF POST-GRADUATE STUDY,

and the Opportunities Afforded at the University of Michigan." Mrs. Stowell has the distinguished honor to have been recently elected Fellow of the Royal Microscopical Society, an honor to a woman accorded to her alone in the United States, and which she shares with only two others, wives respectively of the president and secretary of the society in London.

The paper discussed the reasons why women teachers were paid inferior salaries to men; named many openings now ready for women if they were only prepared to fill them; and dwelt at length upon the intellectual and pecuniary advantages derived from post-graduate work. Women were urged to make more thorough and adequate preparation. There was great need of competent women as superintendents and physicians in our reformatory, penal, and charitable institutions, and especially should they be found in insane asylums. The facilities for post-graduate study in Michigan University were shown to be exceptionally good. Mrs. Stowell's paper will be published in full.—*Inter-Ocean.*

THE BACILLUS OF CHOLERA (KOCH).

Through the kindness of Dr. J. S. Kinyoun, of Centerview, Mo., I have recently received a slide of pure cultivation comma bacillus, the pathogenic cholera bacillus of Koch, and have had opportunities for a close and prolonged examination of the micro-organism in question. I had previously had an opportunity of studying a slide prepared in Dr. Koch's laboratory, under his direct supervision, and I find the two slides apparently identical, so far as the bacilli are concerned. The studies were made with a one-sixteenth first-class immersion objective (Bausch and Lomb) and a half-inch eye-piece, giving an amplification of about 3,200 diameters. Candor compels me to say that I can see no difference between the comma bacillus as shown in these slides and bacilli found by me in dust, in water, and in deposits from the atmosphere at various times in St. Louis and elsewhere. Of course I do not pretend to place my limited experience and facilities against those of Dr. Koch and other savants, who declare that the comma bacillus is different from other organisms having the same general appearance. The standing of Dr. Koch, the completeness of his work in other departments of microscopy, especially his great achievement in tuberculosis, a work that will forever stand as a monument of careful, thorough, honest research, should alone make one very careful in drawing conclusions contrary to his dictum. —*F. L. James.*

HEPATIC CELLULE.

In choosing an animal upon which to carry out my histological work, after trying quite a number of different kinds of vertebrates, I settled at length upon the domestic rat as the best, and for these reasons: It is a small animal, easily obtained in almost any numbers, and sacrificed almost as easily as frogs. The hepatic cellules of the rat are extremely neat and clear, and is the rarest of things to find them charged with the fatty granulations sufficient to impede observation. Let us then take a rat, an ordinary rat, *mus decumanus*, and cut his head off. Taking off a bit of his liver, say a tenth of an inch in diameter, we put it into one or two cubic centimeters (from 15 minims to a half drachm) of a one *per cent.* solution of osmic acid and leave it there from 12 to 24 hours. After washing thoroughly in distilled water to get rid of the excess of osmic acid, we put it on a glass slip, and covering it with a drop of water, proceed to disintegrate it by tearing it with needles. Since the elements have been fixed, this process is a comparatively easy one, and by this means we obtain a vast number of hepatic cells beautifully isolated, which can be mounted and examined at leisure. —*Cincinnati Med. News.*

NEWSPAPER SCIENCE.

It would be difficult to crowd into one sentence more utter and ridiculous nonsense than is to be found in the following paragraph, which originally appeared in the "scientific" notes of the New York *Sun*, and which is republished, without comment, in a similar column of a prominent medical journal, whose editor should know better:

"A German chemist advertises that he will furnish Koch's comma bacillus"—the supposed infective germ of cholera—"ready mounted on slides for popular use in microscopes," As there seems to be some foundation for Professor Koch's statement that these germs, though harmless when dry, recover their activity when moistened, the "popular" microscopist will do well not to fool with these slides during this summer, lest he might accidentally drop one of them into a pitcher of drinking water."

Considering that these bacilli, in the course of preparation for use under the microscope have passed through several mechanical and chemical processes, any one of which would kill them if they were ten times as tenacious of life as they really are, and that their stained bodies are hermetically sealed in glass and Canada balsam, nothing could be more ridiculous and absurd. And yet this is only one specimen of the "rot" which passes current as science in the daily press, and whose only effect can be to needlessly alarm the timid, and retard popular scientific information.—*F. L. James, in National Druggist.*

NOBERT'S RULING MACHINE.

The world renowned ruling machine of the late M. Nobert was exhibited at the last meeting of the Royal Microscopical Society. It has been purchased by Mr. Frank Crisp, one of the secretaries. The foundation of the machine is the ordinary dividing engine used in the graduation of circles and sextants; this, by a vast amount of delicate superposed mechanism, is made to rule lines at a very minute but determinal distance; strange to say, the lines are not straight ones, but portions of a large arc; the lines, however, not exceeding one-fiftieth of an inch in length, the curvature is not perceptible. The diamonds used for ruling are worked to knife edges, in some instances ground, in others clipped, but made with such delicacy that microscopical examination fails to detect any serrations; in this and the glass employed would seem to lie the secret of the fine quality of lines produced by M. Nobert. The note book of the inventor accompanies the machine, and in it the performance of each diamond has been recorded, and much useful information that will probably enable the machine to be used. Experts who have examined the machine since it has been in England do not consider the mechanical contrivances the best that could have been devised; but the fact nevertheless remains that Nobert contrived to execute rulings which have not been equaled. The resolution of the nineteenth band, in which the distance of the lines—according to Dr. Piggott—is 112.595 to the inch, and formerly supposed to be impracticable, is now

accomplished without much difficulty. There is also an adaptation for ruling the longer and comparatively coarser lines for diffraction plates for spectroscopes.

WHY DO DRY MOUNTS FAIL?

BY M. A. BOOTH.

In looking over my collection of slides, procured both by purchase and exchange, and representing the work of European and American preparers, with a view to noting their keeping qualities, I have been so surprised at the number of failures as to query whether permanence in microscopical work is possible. Why is it that so large a proportion of dry mounts—the first for the beginner to essay and the simplest, the mere protecting the object from dust and moisture—fail? Obviously that motto which should emphatically be the microscopist's motto, "*Festina lente*," is not heeded by all workers. The advances in the merely mechanical portions of mounting have evidently not kept pace with those in its purely scientific departments, or else microscopists sometimes forget to take counsel of their good common sense in the use of cement. In this collection are slides which have cost hours of skillful manipulation and yet are utterly ruined because of inattention to the details of the proper use of cement. How do we sometimes apply balsam to a mount? By running it over the cover and trusting to capillary attraction to fill the field. But why should this law of capillary action be operative in the case of the balsam and suspended in that of the cement?

From careful observation and a not limited experience—I speak of dry mounts of diatoms and the like—I am convinced that success or failure depends not so much upon the kind of cement used as upon the care with which it is used.

In my own work, however, I have fixed upon white zinc as the most reliable cement, and I have sent out hundreds of slides made with this cement accompanied with the request that all failures be returned, so that I might replace them with perfect slides; but not a slide has ever been returned. It has been my experience that white zinc properly prepared and properly used never fails. The secret of success with good white zinc, is that

the rings shall be *thoroughly dry*—prepared at least forty-eight hours, and preferably more, before using. I am now making up my summer's supply of white zinc rings. It may be objected that so much drying consumes too much time. Slides can be ringed at the rate of a gross an hour—and this at odd moments when no other species of microscopical work is possible. These slides, packed in rack-boxes, occupy but little space, are free from dust, and reliable slides are always ready for immediate use. For striping, I use artists' colors ground in oil and mixed in dammar. If a narrow, white zinc ring is desired, a coat composed of copal varnish and Brown's rubber cement preserves the oil-colors and gives firmness to the ring without adding to its apparent width.

In deep cells for opaque mounts, I do not find those slides whose cells contain an aperture any more free from dewy deposits upon the cover than those which are hermetically sealed. The following described cell I have found very satisfactory in my own use. Use no volatile substance within the cell; paste a dead black paper upon a white (not much glazed, and therefore absorbent) one, and from this cut with a gun-punch disks, of the desired size; center a slide and paste a disk upon it—black side down, to exclude the light; upon this cement with gold-size a brass curtain-ring—flattened or not, according to the depth of the cell required; run on a background with any shade of water-color paint which best exhibits the object, leaving a white margin around the edge of the cell; cement the cover with a small quantity of white zinc to the ring; color the cells as may be desired; run on the copal mixture already described, giving added security to the cover and rounding out the cell. This makes a neat and durable mount, and no dewy deposits have ever, to my knowledge, appeared upon the covers of cells so made.

With regard to the prevention of "dewing" in transparent mounts, I may add that I have found it essential that the objects should be *thoroughly dry*. If diatoms, use the covers direct from the brass mounting-table; or if such have been breathed upon, as scales, see that the moisture is fully evaporated, and in sealing use the smallest quantity of cement consistent with a perfect adhesion of the cover-glass.—*Microscopical Bulletin*,

THE PROPER CARE AND USE OF MICROSCOPE LENSES.

BY WILLIAM WALES.

However good the lenses of an instrument may be, they will not do their best work except when properly cared for and properly used. Yet I have met with reputable microscopists who do not in practice appreciate this obvious truth.

Let me show you how a lens is cleaned. My implements are four,—an old, soft, silk handkerchief, a small stick of soft wood, a phial of alcohol, and a watch-maker's glass of two powers.

I have here an eye-piece. I will first examine it with the magnifying glass, by reflected light, to learn its condition. If it be found to need cleaning, alcohol is to be applied with the handkerchief. This liquid must not be allowed to touch the lacquer; but the cell which holds the lens will not be harmed by it, since that has been burned black with acid. If, after the cleaning, fibres from the cloth be found adhering to the lens, they may be blown off by a quick breath.

I have brought an objective which was sent to me to be cleaned. I will attach it to an instrument, and will place under it a slide of familiar diatoms. Now view the object through the lens. It looks so obscure that you will all exclaim, "Well, this is a very poor objective;" whereas, it is of excellent quality, as you shall presently see. In it are eight pieces of glass. The back combination is composed of two crowns and the flint; the front, of two crowns, with a flint between them. It has, probably, not been cleaned for twenty years. Suppose your watch to have been thus neglected! I will now clean this objective. I begin the work by unscrewing the cells. I then moisten a part of the handkerchief with alcohol, and, with the help, if needed, of the stick of wood in reaching the corners, carefully clean each combination, and I then screw each cell back accurately to its place. The work is now finished, and I will attach the objective again to the microscope, and will again ask you to view the slide of diatoms through it. The dimness is now, you perceive, all gone. Indeed, you can hardly believe it the same objective; and you have ocular proof that clearness is essential to the

best performance of a lens, and are witnessing an instance of the dependence of important results on attention to little things.

Several years ago, while I was getting ready to visit England, the owner of a Powell and Leland objective wished me to take the lens to its makers for correction or exchange. "It is a poor lens," he said. I could not credit his statement, for I knew the work of Messrs. Powell and Leland to be faultless. I called on those gentlemen. We examined the objective together, and discovered on one of the combinations a film of some substance which could not be removed except with alcohol. In five minutes the lens was clean and in perfect order; and to this day the owner refuses to believe that the lens which I brought back to him is the same as that which I took abroad.

Never trust the cleaning of your objectives to the brass-worker, or to any person who does not know how carefully a lens ought to be handled. The brass-worker will polish the outside of the objective, but will get the lenses out of center. To my great disgust, I once found a brass-worker subjecting one of my $\frac{4}{10}$ths-inch lenses to that treatment. I asked, "What are you doing with that objective" "Putting it in order, at the request of its owner," he said, "he wants to sell it." Taking the lens, I cleaned it for him without charge.

A camel's-hair brush can neither completely nor safely remove the film of dust with which the exposed surface of the back combination of an objective is sometimes coated. It will make a series of rings on the surface of the lens, and it may, if grit be present, scratch the glass. Nor should the handkerchief, either wet or dry, be introduced into the tube of any but a low-power objective. The cells must first be unscrewed from their mountings, and then the cleaning can be done properly. But, let me add,—

An objective ought never to be taken apart by any one but its maker. He has the lathe upon which it was made; and he alone, when the parts have been separated, can replace them in their original adjustment to the optical centre. Any other person will be likely to screw in the cells either too tightly or not tightly enough, and will thus throw the combinations out of

their necessary delicate relation to one another. Besides, unless skill and care be exercised in screwing the parts together, the front and the middle combinations will sometimes be brought in contact, and the flint glass, which is very thin at the centre, will be broken. The screw-thread of the cells is very delicate. Yet some persons, after failing to catch it, apply force enough to break it. Such carelessness passes comprehension.

A large-angle oil-immersion lens gets out of order easily. If you find the definition of such objective to have lost its sharpness, you may know that the front lens is out of centre. It has come in contact with the slide. A very slight pressure is sufficient to work the mischief. This susceptibility to injury is unavoidable, as every optician will tell you. It is incident to the requirements of high-angle construction.

A few days ago an objective was sent to me with the request that the front lens should be reset. It had in some way been forced out of its place. I reset it as well as I could. But that objective, even if it had been repaired by its makers, the Messrs. Powell and Leland, can never be what it was before the injury. The only way of repairing it was by inserting a ring of cement which, projecting slightly through the shoulder, necessarily cut down the angle. A heavy shoulder means, of course, a low angular aperture.

A novel method of using an immersion lens came under my notice recently. A water-immersion objective had been ordered. It was made and sent, but it did not give satisfaction. I inquired by letter, "In what way do you proceed to work with it?" "I fill it with distilled water, and then screw it to the instrument," was the reply.

An objective is sometimes almost ruined through sheer carelessness. I made a costly lens for a New York optician. He tossed it several times in his hand, and finally dropped it upon the floor. "Oh," he said, "that will not harm it!" I looked at it, and found the front combination tilted at an angle of about forty-five degrees. This act of carelessness cost that optician twenty-five dollars.

I have here the back setting of a $1\frac{1}{2}$-inch lens which was made by me several years ago. The purchaser of the lens had screwed it so tightly to his microscope that he could not, with

his hand, unscrew it. So he used a pair of heavy gas-fitter's pliers, and succeedeed in pulling the tube of the fine adjustment out of the body of the instrument. This rude handling damaged the microscope to the amount of forty-five dollars.

Quite recently the owner of an instrument which cost three hundred and fifty dollars told me that he had a wonderfully clever son. "Why," he exclaimed, "he has, with a screw-driver, taken the microscope all apart! He is unable, however, to put it together again." This outrage illustrates the incapacity of some people, old as well as young, to appreciate the products of fine workmanship.

I do not favor the nose-piece. If you must have one, choose one that is of good design and thoroughly well made. Lenses, especially those of high power, ought not to be tested with the use of this accessory.

A superior lens, worked by an illustrious microscopist, becomes its maker's best advertisement. But when it falls into the hands of a careless or incompetent person, and is not carefully used or regularly and properly cleaned, to hold the maker responsible for its consequent unsatisfactory performance is to do him great wrong.—*Journal N. Y. Mic. Society.*

AMERICAN vs. FOREIGN MICROSCOPES.

Some time ago when the subject of American vs. Foreign microscopes was being agitated in the microscopical and scientific press of the country the *National Druggist* took the ground that in everything pertaining to the "stand," convenience, beauty of design, accuracy, and fineness of finish, and general superiority of workmanship, American microscopes were away in advance of instruments of European make. The idea was ridiculed by some of our eastern contemporaries, and the *Science Record* went so far as to print a list of American workers who preferred foreign instruments. The position taken by the *National Druggist* has just been signally confirmed from a very unexpected source, viz.: the *Journal de Micrographie*, the leading microscopical monthly of France. The editor, the well-known Dr. Pelletan, in introducing an article on Bertrand's Mineralogical Microscope, says: "The readers of

this journal will bear witness that for ten years past I have struggled with French microscope makers to add to their instruments those improvements which make the English and American microscopes the first and best in the world, not only in design, (conception), but in mechanism." Score one more for the *Druggist*.—*F. L. James.*

REVIEWS.

TEXT-BOOK OF STRUCTURAL AND PHYSIOLOGICAL BOTANY. By Otto W. Thomé, and Alfred W. Bennett. Illustrated with 600 woodcuts and a colored map. Fifth edition, revised and corrected, 1885. Longmans, Green, & Co., London, England.

It was about eight years ago that the first edition of this well known text-book was introduced. During these years very great advance has been made in various branches of botanical science. Many of the lower forms have had their life history followed out for the first time; this has made it necessary to replace the older classification of the lower cryptogams, as given by Thomé, by a system more in keeping with modern research.

Prof. Bennett seems to accept the recent researches on the "continuity of vegetable protoplasm," at least he speaks of its existence "in some cases, especially in endosperm-cells, in the motile organs of such leaves as those of *Mimosa*, and in the fronds of many Florideæ. Here very delicate threads of protoplasm pass through the cell-wall, and maintain a connection between the protoplasmic contents of adjoining cells." He also fully accepts and describes the changes that occur in the nucleus in the course of the division of the cell. This whole chapter on "the cell as an individual" is, we should judge, entirely new. Other important changes occur, all aiming to bring the present edition fully abreast of the most recent discoveries and observations. The members of the American Society of Microscopists who had the pleasure of meeting Prof. Bennett, at Rochester, last summer, will surely desire a copy of his latest work, and all botanists will certainly need it.

THE ELEMENTS OF BOTANY. By W. A. Kellerman, Ph. D., Professor of Botany in the Kansas State Agricultural College. Copiously illustrated. pp. 360. Price $1.50. John E. Potter & Co., 617 Sansom St., Philadelphia. 1885.

This work embraces organography, vegetable physiology, systematic botany, histology, etc. About fifty pages are devoted to the microscopic structure of plants, and to the vegetable cell. The author speaks of this as "the new departure," but it can hardly be called such when we consider that all the more standard works on botany devote even more space in proportion than is given here to "the minute anatomy or histology of plants." In fact, no botanist would think of issuing a work without more or less prominence to this particular branch, and, we are ready to add, the more prominence given to it, so much the more welcome and valuable will be the book. While a large number of the illustrations are new, still their value would be much greater if both the artist and the engraver had shown more skill. Taken as a whole the work will rank as a fair exponent of elementary botany. We will be glad when Prof. Kellerman gives us a book devoted entirely to Vegetable Histology.

THE TECHNOLOGY OF BACTERIA INVESTIGATION. By Charles S. Dolley, M. D. 8 vo. pp. 260. Price $2.00. S. E. Cassino & Co. Boston. 1885.

Dr. Dolley gives us explicit directions for the study of Bacteria, their culture, staining, mounting, etc., according to the methods employed by the most recent investigators. The work comes from an earnest student in this branch of scientific research and will be of inestimable value to all interested in the facts concerning Bacteria. Dr. Dolley is now at work at the Naples Zoölogical Station and that he is doing most excellent work there is no question. The most complete and explicit directions are given for the study of living forms, the preparation of fixed and hardened forms, culture experiments, and inoculation experiments. Special methods are given for investigating Pathogenic Bacteria, and a large number of formulæ close the work. It is sufficient to say that any one trying to do work in this field will be very unwise to continue longer without a copy of this book by his side. It is clear, concise, and complete.

The publishers give us the good press-work, paper and binding characteristic of their house.

MANIPULATION OF THE MICROSCOPE. By Edward Bausch. Illustrated. 12 mo. pp. 100. Price 50 cents. 1885. Address the author at Rochester, N. Y.

The author starts out with the supposition that the purchaser, or owner, is a beginner and absolutely ignorant of the microscope and everything pertaining to it. Then step by step proceeds to consider the elementary manipulation of the instrument, and finally closed with directions for advanced manipulation, illumination and testing objectives. It is a very ignorant man indeed who cannot find profit from a perusal of this little work.

SANITARY SUGGESTIONS ON HOW TO DISINFECT OUR HOUSES. By B. W. Palmer, A. M., M. D. pp. 60. Price 25 cents. George S. Davis, Detroit. 1885.

We have before us a resumè of the latest and best information on the Household Use of Disinfectants. It is the great study of the day how to prevent the development of infectious diseases, or when once originated, how to reduce their further spread to a minimum. Dr. Palmer points out the use and application of the best agents employed for this purpose, and he has done his work in such an easy, simple way that anybody of ordinary intelligence may take advantage of them. We wish this little *brochure* could be in every household.

RECENT PROGRESS IN THE IMPROVEMENT OF THE MICROSCOPE. By R. H. Ward, M. D., F. R. M. S.

This consists of the proof of an article on "Microscopy," in the Annual Cyclopedia for 1884, as issued by the Appletons. Dr. Ward has done his work well and the publishers are to be congratulated on having such an article in their annual.

OSMIC ACID.—Osmic acid, the effect of which in the study of the cornea and the hepatic cellules, was mentioned last week, has another property, which is destined to yield important results in histological investigations—viz., it arrests the diffusion of glycogen, and prevents its transformation into glucose, and that without interfering with its characteristic reaction toward iodine. As glycerine is one of the constant histological elements of the fœtal epidermis, cartilage, and other portions of the organism, but which, from its instability, has not been thoroughly studied, Professor Ranvier congratulates himself upon the discovery of the osmic acid reaction. Unhappily, the iodine alone, of all the reagents yet tried by him, differentially colors the glycogen, and the effects of the staining are very evanescent.—*National Druggist.*

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

FOR EXCHANGE—Mammoth Atlas of Human Anatomy, 45 parts, unbound, by Drs. Vesterreigher and Erdl. Cost me $33.75. Will exchange for $20 worth of accessories or objectives.
DR. C. H. LOVEWELL, Englewood, Ill.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED to exchange a Seiler's section knife carrier (new) for a good microtome or turn-table.
J. T. WAID, M. D., Ridgway, Pa.

WANTED--Microscope stand and microscopical books and journals. Will give various articles or cash for same, Send for list. C. VON EIFF, Jr. 347 Greenwich St., New York City.

WOULD like to exchange a 1-6 in. object, drv, 160° for a first-class microtome.
J. B. JENNINGS, 78 Mayor block, Chicago, Ill.

WANTED.—One second-hand turn table; also one second-hand section cutter for soft material; also one second-hand micro-dictionary. Above must be very low priced and in fair order. Send description of style and cost to E. S. COUTANT, 1022 Woodland ave., Des Moines, Iowa.

WILL EXCHANGE OBJECTIVE.—An adjustable Nachet 1-9 (dry)—society screw, with *very long* working distance—has moderate angle. Correspondence solicited.
E. T. BECKWITH, M. D., Urbana, Ohio.

TO EXCHANGE—Pulvermacher chain battery (100 elements) for applying electricity to the body—cost $30 for cheap microscope stand, slides, minerals or lantern slides.
J. CROWTHER, 320 Pleasant St., Fall River, Mass.

FOR EXCHANGE—A good refracting telescope 2¼ in. operture which will resolve Epsilon Lyra with half inch eye piece—value $65, will exchange for a first-class Bausch & Lomb objective.
J. E, WHITNEY, Rochester, N. Y.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg. Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

WILL exchange mounted slides of various minerals (native crystals), and others, for well mounted slides. WILL H. OLMSTED, Syracuse, N. Y.

EXCHANGE.—Parties having diatomaceous earths or other microscopical material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow, Msss.

QUEEN'S New Sub-Stage Condenser, with dividing combination for high or low powers, and three Caps, for sale or exchange. DR. A. C. STOKES, Trenton, N. J.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FRESH-WATER ALGÆ, nearly all genera, and many beautiful varieties; also Euglena, Astasia, etc., for good pathological or other interesting slides. Lists exchanged.
J. M. ADAMS, Watertown, N. Y.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

HISTOLOGICAL SLIDES, very thin and evenly cut, well mounted and well ringed, will be exchanged for Pathological or Histological slides only.
H. L. WHITNEY, M.D., German Hospital, Philadelphia, Pa.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

FOR SALE.—Slides, double stained, of Bacillus Tuberculosis, 50c. each.
DR. W. R. CHITTICK, 86 Lafayette Avenue, Detroit, Mich.

WANTED.—Books treating on microscopical and histological subjects not already in my possession. Will pay cash, or give slides in exchange. State name of the work, date of issue, and price. C. H. STOWELL, Ann Arbor, Mich.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

PATHOLOGICAL, Histological, and other well mounted slides will be exchanged for mounted specimens of interest. Lists furnished on application.
D. E. HAAG, M.D,, Liberty Center, Henry County, Ohio.

THE MICROSCOPE.

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ORIGINAL COMMUNICATIONS.

THE MICROSCOPIC STRUCTURE OF COPTIS TRIFOLIA.

LOUISA REED STOWELL.

GOLDTHREAD was such an important American drug at one time that Dr. Bigelow said: "Of this article larger quantities are sold in the druggists' shop in Boston than of almost any other indigenous production."

It appears now to be principally employed for domestic use for sore mouths, hence called Mouth-root and Canker-root. It is extensively used in domestic medicine in France as an appetizer and general tonic. The slender, wiry, bright yellow rhizomes give it its appropriate name of Gold-thread. The microscopic structure of its various parts is both interesting and beautiful.

Rhizome.—On the outside of the rhizome is a row of epidermal-like cells, having a thick, clear, white wall, thickened on the outer surface, thus resembling the cuticle. Occasionally it surrounds the entire cell. The most of these cells are empty, though a few of them are colored a bright yellow. These cells are quite uniform in size and shape. On a cross section they are round or square, but on the longitudinal section they resemble the cells of the epidermis of the leaf over the midrib or prominent veins. They are long and narrow, and the walls are not of uniform thickness, but covered with irregularly placed nodules.

The outer two or three rows of cells of the parenchyma are smaller, with walls considerably more thickened, than the rest. The walls are a clear white, even glistening like collenchyma. They are frequently empty, sometimes containing a few starch-

grains, chlorophyll bodies (without the chlorophyll) bright yellow coloring matter, and oil. In the minute inter-cellular spaces occasionally resin is found.

The remainder of this parenchymatous portion of the rhyzome is composed of large, oval, thin-walled cells, with numerous small inter-cellular spaces. The majority of the cells contain small, round starch-grains (see Fig. 1). Many of these cells are modified glands or sacks, and contain the bright yellow coloring-matter. The cells forming the rows from the third to the sixth from the outside of these parenchymatous cells are apt to contain oil and the coloring-matter in greatest abundance. Minute par-

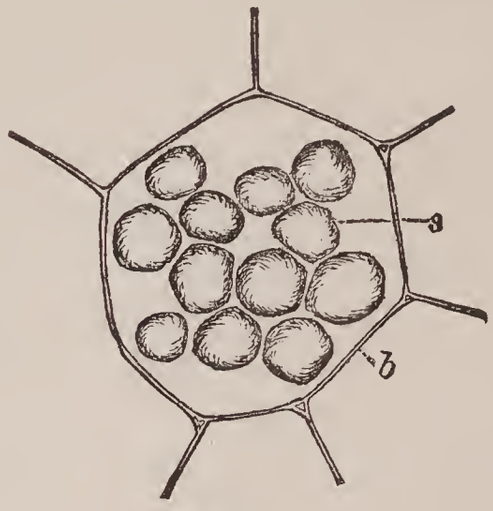

Fig. 1.

A single cell of starch-bearing parenchyma from the rhizome, filled with starch-grains; *b*, parenchyma: *s*, starch-grains. Drawn with the 1/8-inch objective and the "C" eye-piece.

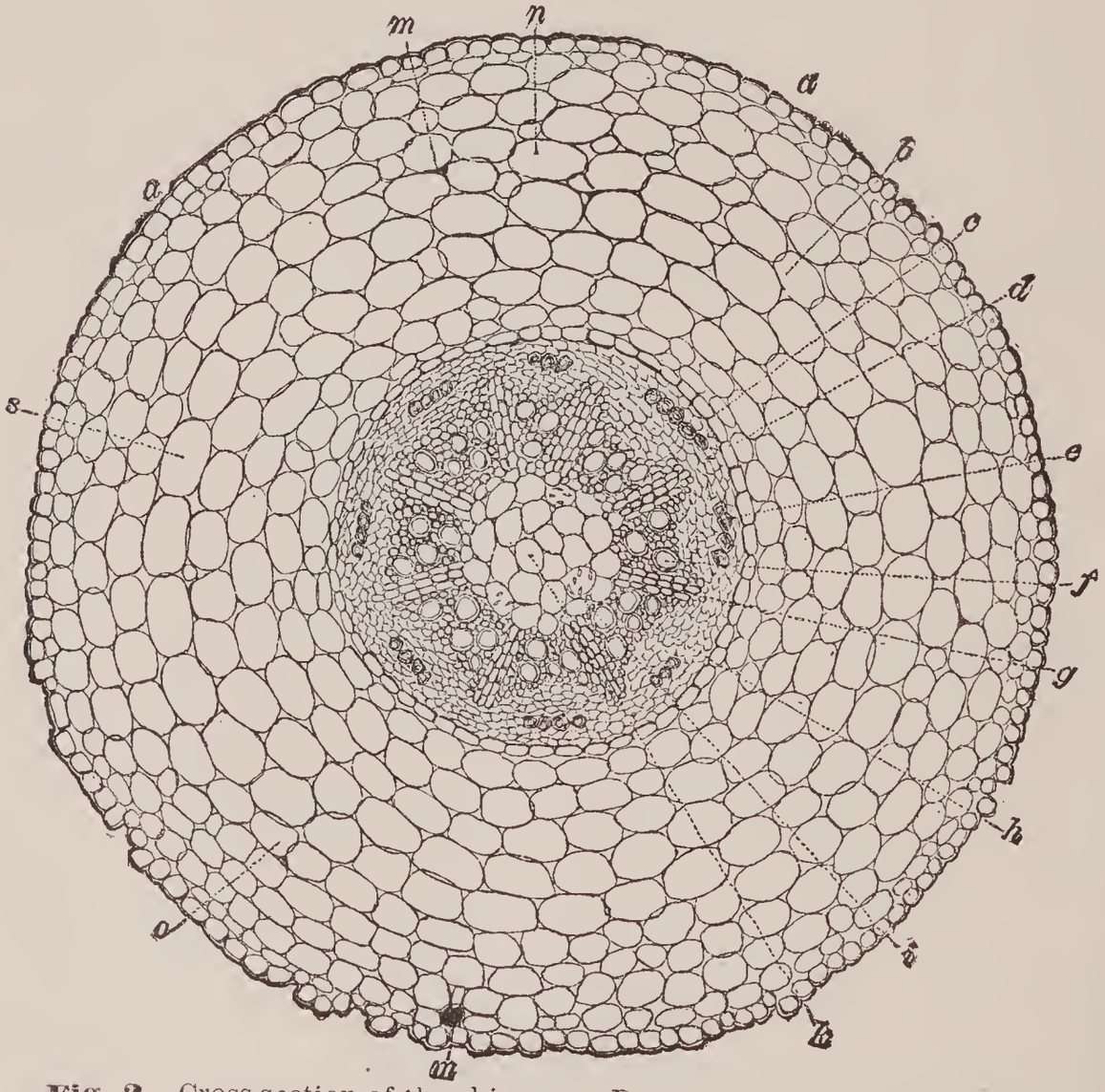

Fig. 2. Cross section of the rhizome. Drawn with the 2/3 in. objective and the "A" eye piece.

ticles of hardened albumen are found in some of these cells. Small masses of resin are found between the cells, or attached to the outside of the cell-wall. The majority of these particles of resin are not more than $\frac{1}{2000}$ of an inch in diameter. A mass is occasionally found (as at *m*, Fig. 2), much larger and firmer, and even $\frac{1}{150}$ of an inch in diameter. This resin is not entirely soluble in alcohol, and is turned a blue color by aniline.

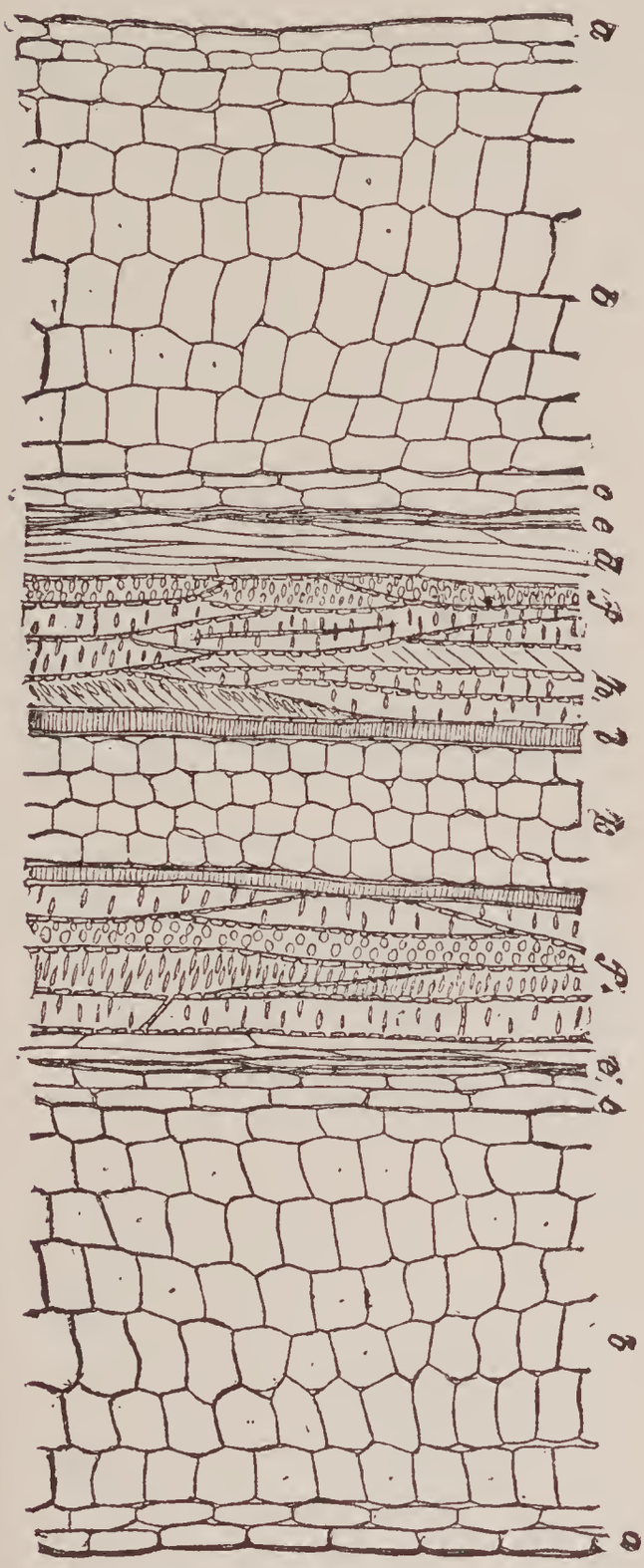

Fig. 3.

Longitudinal section of the rhizome. Drawn with the ⅔-in. objective and the "C" eye-piece.

Just inside of this parenchyma is the endodermis, loaded with a dark-yellow coloring-matter. On the cross section, the cells are thick-walled, small, oval or square; but on the longitudinal section they are four or five times longer. The endodermis is the dividing line between the starch-bearing parenchyma and the liber part of the rhizome. There is quite a difference in different rhizomes, both in the size and color of these cells, and they differ even in the same rhizome according to their distance from the leaf-bearing end.

Inside of the endodermis are found simple, thin-walled, hexagonal cells of phloëm, containing protoplasm and albumen. Embedded in this phloëm are clusters of liber fibre, each cluster containing from three to eight small, bright yellow, hexagonal cells of prosenchyma, having several successive layers of

cellulose in their thick wall. These are about $\frac{1}{300}$ of an inch long, and have many radiating lines or breaks, as seen in the longitudinal section.

The woody part of the rhizome is composed of poorly developed medullary rays, wood prosenchyma, and pitted cells, with a few spiral vessels; all colored bright yellow.

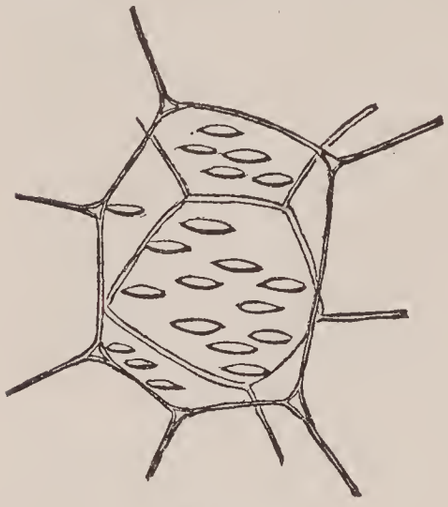

Fig. 4.

A single cell from the parenchyma of the pith with reticulated markings. Drawn with the 1/8 in. objective and the "A" eye-piece.

The pith in the center of the rhizome is composed of very thin-walled oval cells of parenchyma, loaded with starch grains. Occasionally a modified cell is filled with coloring-matter. Around the outside edge of the pith are a few parenchymatous cells having distinct reticulated marks (see Fig. 2, *i*, and Fig. 4). Many of the cells of the parenchyma, both at the center and the outside of the rhizome, have faint reticulated marks, which show both on the cross and longitudinal sections.

Root.—The root is surrounded by many fine root-hairs, in which is found a small amount of protoplasm. The most of the root is composed of large, thin-walled, oval cells of parenchyma. The most of these contain minute starch-grains (see Fig. 6), and some of the larger cells contain coloring-matter and oil.

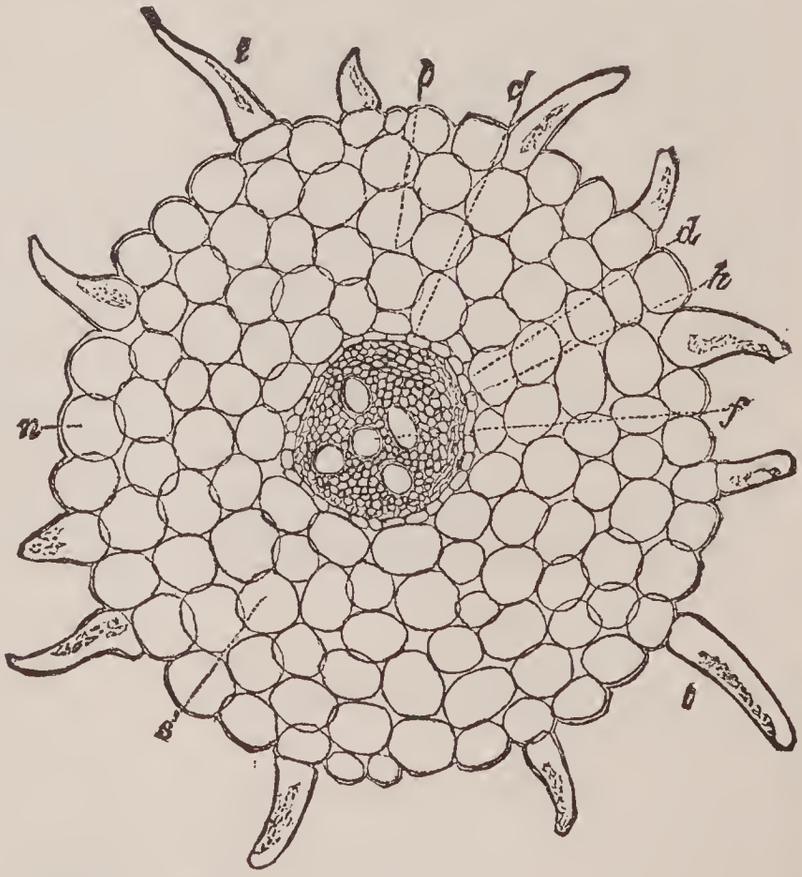

Fig. 5. Cross section of the root. Drawn with the 2/3-in. objective, and the "C" eye-piece.

In the center of the root is found the

usual small, woody cord, composed of first the endodermis, then the phloëm, wood prosenchyma and pitted cells. All except the cells of the phloëm are colored a bright yellow.

Fig. 6.

Starch-grains taken from the root. Drawn with ⅛-in. objective, and the "C" eye-piece.

Leaf.—On the midrib of each leaflet, in elongated clusters, toward the base of the leaflet, are short, unicellular, thick-walled white hairs, with minute nodules covering the surface of the hairs (see Fig. 7). Many of these are curved and pointed towards the apex of the leaflet. These hairs contain a small amount of protoplasm, generally dried down in particles, but in the young leaf it is fresh, and exhibits a nucleus. Coloring matter is not found in these hairs.

Fig. 7.

The epidermal hairs found on the upper surface of the leaves, directly over prominent veins. Drawn with the ¼in. objective, and the "C" eye-piece.

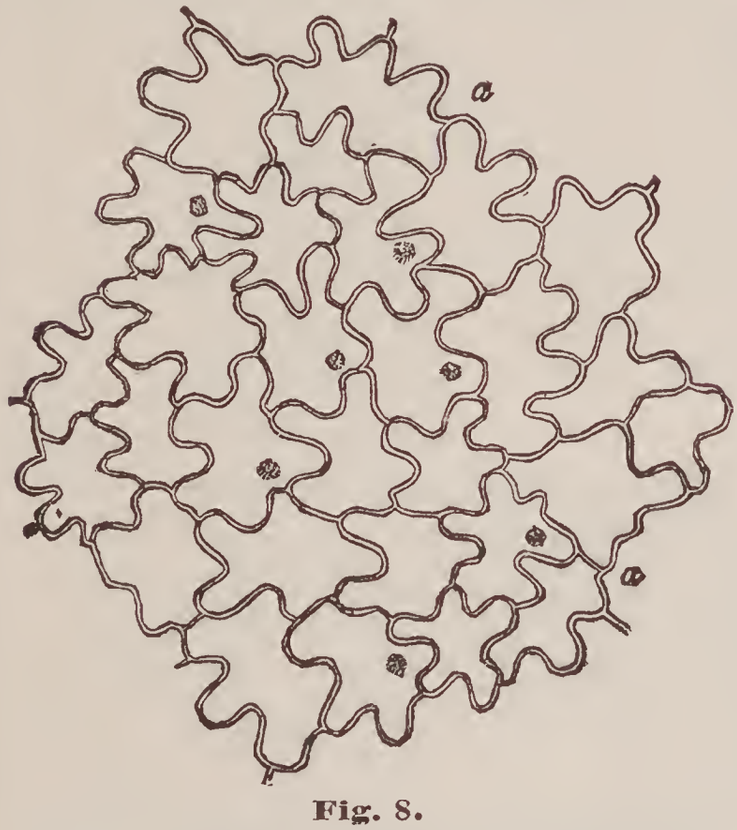

Fig. 8.

Epidermis from the upper surface of the leaf, showing only the epidermal cells and an occasional nucleus. Drawn with the ¼-in. objective, and the "C" eye-piece.

The entire upper surface of the leaf is covered with a clear, white, thick, firm cuticle. This cuticle is laminated, or composed of five or seven layers of cellulose placed parallel with the surface. The cuticle on the lower surface of the leaf is more delicate, only about one-half the thickness of the upper.

The epidermis on the upper surface of the leaf is about $\frac{1}{800}$

of an inch wide, and composed of large, quite regular, clear-white, deeply serrated cells; containing in the young, fresh leaves some protoplasm and an occasional nucleus (see Fig. 8). Very few stomates, if any, are present. The epidermis on the under side of the leaves is about $\frac{1}{1600}$ of an inch thick, and composed of thin-walled, empty, deeply serrated cells (see Fig. 9). The numerous large stomates are set a little below the level of the epidermis, and the guard cells of the stomates are filled with chlorophyll bodies.

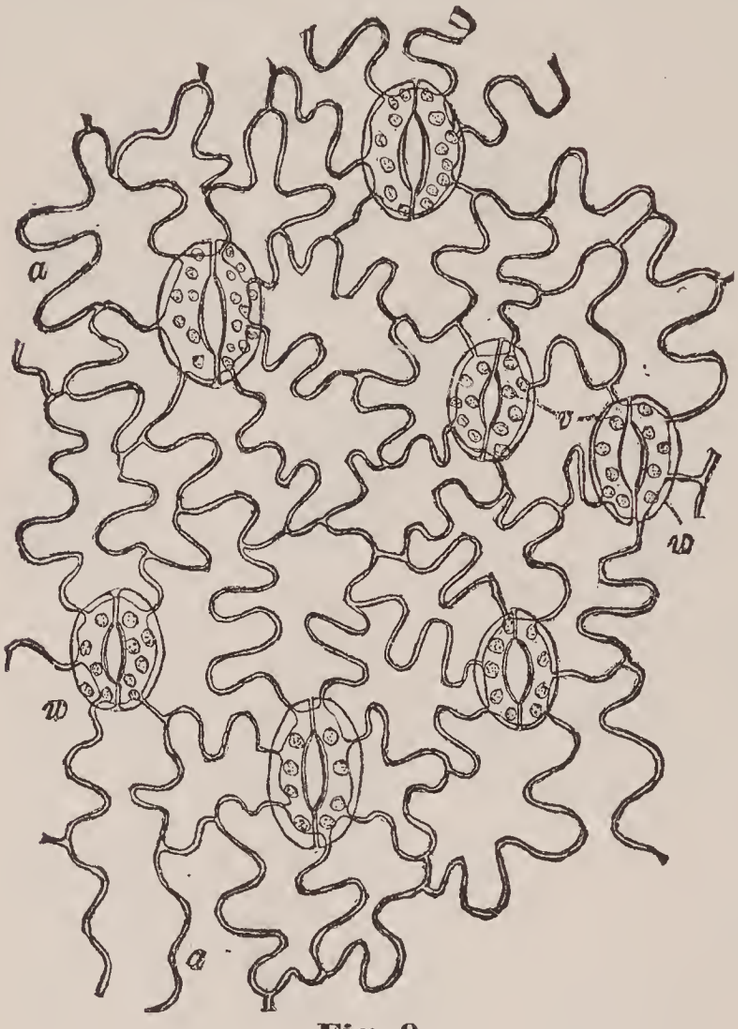

Fig. 9.

Epidermis from the lower surface of the leaf, showing the epidermal cells and the stomates, with the chlorophyll bodies in the guard-cells of the stomates. Drawn with the ¼in. objective, and the "C" eye-piece.

The center of the leaf is composed of the usual palisade cells and loose parenchyma, with numerous large intercellular spaces (see Fig.

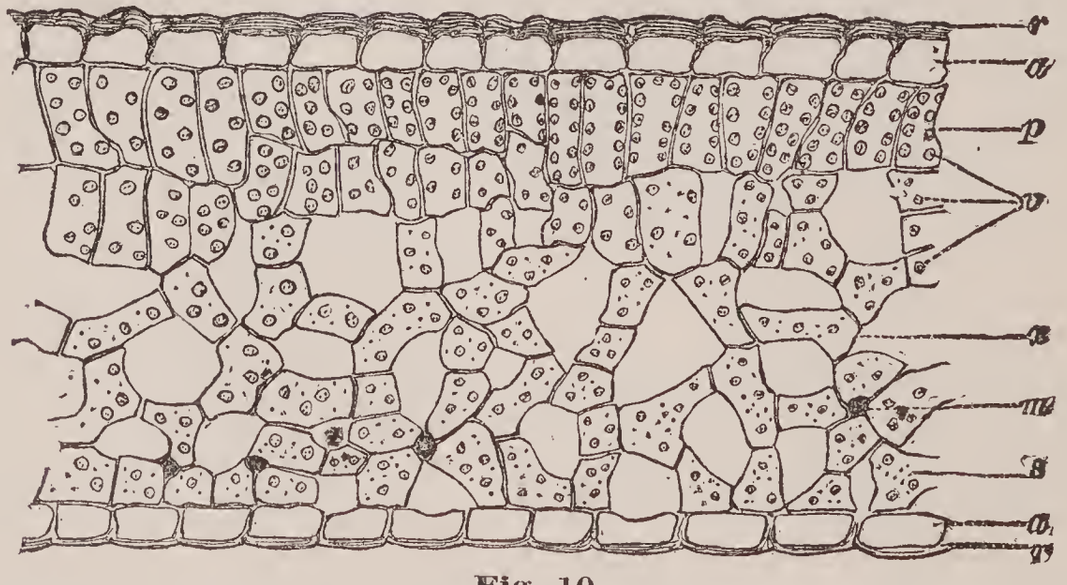

Fig. 10.

Cross section of the leaf, showing none of the frame-work, but only the fleshy part of the leaf. The section is taken at right angles to the midrib. Drawn with the ¼-in. objective, and the "A" eye-piece.

10). The palisade cells are delicate, not uniformly of the same length, and filled with chlorophyll-bodies, of which many have an oval, rather than the usual round form. The cells of the loose parenchyma contain only a few chlorophyll-bodies, and numerous minute starch-grains; also oil and albumen. In many of the cells bordering on the vascular system of the leaf the bright yellow coloring-matter of the coptis is found. In a few of the small inter-cellular spaces of the loose parenchyma towards the lower surface of the leaf are small masses of resin.

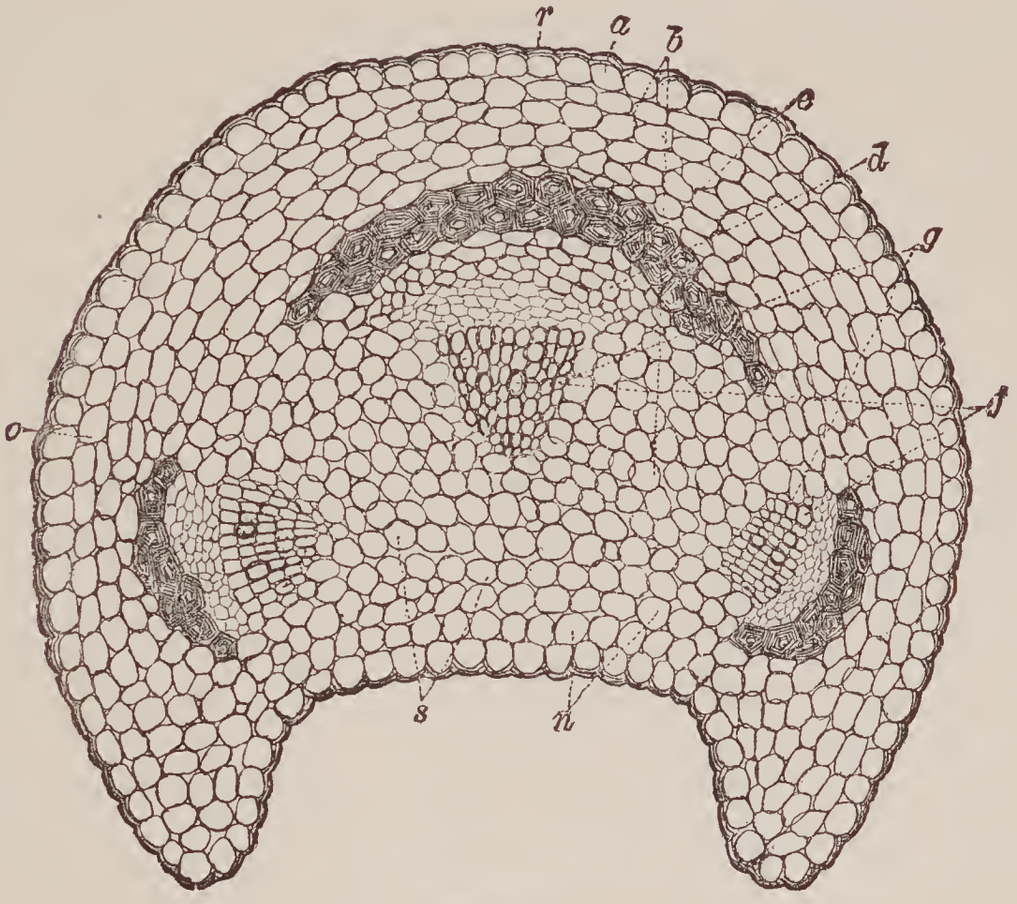

Fig. 11.

Cross section of the stem of the leaf, cut midway of the stem. Drawn with the ⅔-in. objective, and the "C" eye-piece.

Stem of the Leaf.—The cuticle is thick, laminated, and in the old stems has taken the peculiar tinge of yellow so common in the plant. It is about $\frac{1}{2400}$ of an inch thick. The epidermis is $\frac{1}{800}$ of an inch thick, and is composed of quite regular cells. These cells are nearly square on the cross section, but on the longitudinal are four or five times longer. Just beneath the epidermis, and especially at the corners of the stem, is collenchyma; thick walled cells filled with chlorophyll-bodies. The bulk of the stem is composed of simple oval cells of parenchyma, generally filled with starch-grains, a few chlorophyll-bodies

and coloring matter. The coloring-matter is present in nearly all the cells adjoining the liber fibre and the woody bundles. The starch is found in greatest abundance toward the center of the stem. Oil is found in a few special glands or sacs just inside of the collenchyma. The bundles of liber fibre and also the wood prosenchyma and pitted cells are of a bright yellow color. The phloém is clear white, very thin-walled, and contains protoplasm. In very small inter-cellular spaces in the outer part of the parenchyma resin is found.

LETTER REFERENCES TO FIGS. 1, 2, 3, 5, 8, 9, 10, and 11.—*a*, epidermis; *b*, parenchyma; *c*, endodermis; *d*, phloëm; *e*, liber fibre; *f*, pitted cells; *g*, medullary rays; *h*, wood prosenchyma; *i*, reticulated cells of parenchyma; *k*, pith parenchyma; *l*, spiral vessels; *m* resin; *n*, cells filled with yellow coloring matter; *o*, oil-bearing parenchyma; *p*, palisade tissue; *r*, cuticle; *s*, starch or starch-bearing parenchyma *t*, root-hairs; *v*, chlorophyll-bodies; *w*, stomates.

HOW TO MOUNT LARGE INSECTS.

ROBERT GILLO gives his process for mounting beetles and other large insects, in the July number of the Journal of the Postal Microscopical Society. He procures, for instance, a common ground-beatle, perhaps half-an-inch long. This he places in a test-tube and adds *Liquor Potassæ*, full strength. Here it is steeped until the solution becomes darkened, when it is poured off and fresh added. Here it remains for ten days or two weeks, when the insect is carefully transferred to a dish filled with distilled water. With one camel's-hair brush the insect is held steady, while with another brush, the body is pressed upon with a kind of rolling motion, until the contents of the abdomen are driven out. The insect is now transferred to clean water, and left for an hour or so, when the squeezing process with the brushes is repeated. By repeating this process, the whole of the contents of the viscera can be removed without the least injury to any of the internal organs.

The insect is still opaque. It is, therefore, necessary to bleach it. For this purpose it is placed in the following solution, until sufficiently transparent, perhaps a week or more: Make a saturated solution of chlorate of potash, and add 10 to 20 drops, or more, of hydrochloric acid to each ounce of solution.

The insect is then thoroughly washed in distilled water. Then place the insect on its back, in a china saucer, and arrange its legs, etc., as desired for mounting. Carefully pour over it alcohol and be sure the legs are not displaced. After several hours, change the alcohol for fresh; and after several hours more, pass the insect into ether. After soaking some hours in the ether, pass into turpentine, where it can remain any length of time.

Make a glass cell slightly larger than the insect, but rather thinner than its thickest part. Arrange the insect and fill the cell with balsam and benzole. The glass cell can be made of strips or glass without much trouble.

WHAT IS A PLANT?

MR. WORSLEY-BENISON has been discussing this question in a very interesting way, and he says in conclusion that "*physiologically* the most distinctive feature of plant-life is the power to manufacture protein from less complex bodies; that of animal-life, the absence of such power." He finds that in form, in the presence of starch, of chlorophyll, in power of locomotion, in the presence of circulatory organs, of the body called nitrogen, in the functions of respiration and sensation, there are no diagnostic characters. He finds, however, "fairly constant and well-marked distinctions," in the presence of a cellulose coat in the plant-cell, in digestion followed by absorption, and in the power to manufacture protein.

The *morphological* feature of plants is this cellulose coat; of animals, its absence; the *physiological* peculiarity of plants, this *manufacturing power;* of animals, the want of it. But after all the discussion he says, "To the question, *Is this an animal or a plant?* we must often reply, *We do not know.*

GUNDLACH'S ONE-FIFTH OBJECTIVE.—Owing to an oversight on my part, credit was not given to Mr. E. Gundlach in your June number, as being the maker of the dry 1-5 in. objective, 135° air, with which I resolved pellucida in new medium. The objective does it easily without being "crowded."

E. F. BECKWITH, M. D.

GLEANINGS FROM OUR FOREIGN EXCHANGES.

C. H. STOWELL.

BEADS OF AMPHIPLEURA. Speaking of the photographs of this diatom made by Dr. Van Heurck, and of the discussion arising from the *beaded* appearance shown by the photograph, this journal says: "Thus in the case of the 'beads' of A *pellucida* the existence of such an image proves that the diatom has not merely a periodic differentiation of structure in one direction, but that such differentiation exists in two directions which cross at right angles." It says further that what the diffraction theory shows is that the *real* form and structure of the beads cannot be determined by the mere inspection through the microscope of their images. The microscope leaves undecided questions of elevation, depression, centres of thickening, etc.

PREPARATION OF SPIDER. The spinneret, leg and falces having been removed from the spider are placed separately in liq. pot. for 24–36 hours; wash in water; place in acetic acid; soak in water; place in alcohol for short time; clear in oil of cloves; transfer to turpentine; mount "without pressure in cells." The tongue of the spider, carefully dissected out, makes a beautiful preparation. The eyes may be mounted in balsam, in cells, as opaque objects, with fine results.

NOTHING NEW. Mr. Crisp exhibited a microscope before the Royal Society made in 1686, which had a spring used for adjusting the focus of the lens, which spring "was the subject of a patent about fifteen years ago."

SECTIONS OF HARD ORGANIZED SUBSTANCES. The object (a piece of hard wood, for instance,) is first filed level with an ordinary file and made more even with finer files. A piece is now cut off from that portion which has been filed smooth. The filed surface of this piece is now fastened to a slide with a drop of Canada balsam. Of course the object is pressed firmly to the slide, and the warm balsam allowed to get cold and hard. Then the section is filed until it is smooth and shining and transparent enough. After the final filing and polishing the section is cleaned with a cloth wet in alcohol, a drop of bal-

sam added and the cover applied. "In this way ten or twelve sections can be prepared in a day."

EMERSON AS A MICROSCOPIST. Dr. Oliver Wendell Holmes mentions in his biography of Emerson, just published, that in 1833 Emerson visited Europe for the first time, and while there called upon Prof. Amici, who showed him his microscope, magnifying (it was said) two thousand diameters. Dr. Holmes says: "Emerson hardly knew his privilege; he may have been *the first American* to look through an immersion lens with the famous Modena philosopher."

LONG TUBES. W. J. Lancaster says we are to have a lengthening tube by all means. He has used tubes two feet in length with most excellent results, although all objectives will not stand it. One diaphragm should be used for about every nine inches of tube, otherwise internal reflections will spoil the definition.

SILICEOUS CEMENT, for protecting corks from the fumes of acid, etc. Mix together equal parts of colloid silica and thick gum-water, with sufficient gilder's whiting to make it of the consistency of treacle.

FOR LABELLING SLIDES.—A good plan is to punch some squares or circles out of very thin talc; cover the end of the glass slip with a thin layer of gilder's whiting and gum-water; when dry, write on this with common ink, let it dry, put a very small drop of Canada balsam upon it; cover with a circle of thin talc, and allow all to dry; then clean the edges with benzole and water mixed. It will not peel off or get dirty like printed labels,

CARBOLIC ACID PRESERVATIVE, for animal and vegetable tissues. Carbolic acid, 1 drachm; alcohol, 2 drachms; distilled water, 12 ounces; dissolve the carbolic acid with the alcohol, then add it to the water and boil it for ten minutes, and bottle for use.

ACETATE OF ALUMINUM.—To 1 part of acetate of aluminum, add 4 parts of distilled water. This is very good for preserving vegetable colors, as in the case of desmids and other algæ.

GLYCERINE AND ACETIC ACID is useful for mounting many minute insects and other objects; it is composed of glycerine, 1 ounce; acetic acid, $\frac{1}{2}$ ounce.

EDITORIAL NOTES.

OUR EIGHTH ANNUAL MEETING.—Most careful preparations have been made for our Eighth Annual Meeting, commencing on the 18th inst. Mr. Vorce has already done a vast amount of work and we are sure we shall soon see some of the fruits of his labors. The President and Secretary give us assurances of a successful meeting, and it seems a foregone conclusion, therefore, that our eighth meeting will outrank any of the others.

It must be borne in mind that, as a society, we are no longer an experiment. Starting with a score of earnest workers, we have had a healthy, rapid growth, until now we can count our members *by the hundred.* It follows, therefore, at our annual meeting, that we must economise the time devoted to our daily sessions, in order to present as much matter as possible. We have no criticisms to make on our business sessions; they have been characterized by great promptness and the best of good feeling. But we must insist upon being relieved and upon relieving our fellow-sufferers, from the lengthy uninteresting papers, read by parties who have become Monomaniacs on their pet subjects.

It is, of course, necessary to have some papers of considerable length; to shorten them would be to ruin them. Again some of these papers may be of such general interest, that, notwithstanding their length, they should be read in full. But what can be said of those papers that occupy an hour or more in reading, upon subjects without interest to over half a dozen members? The Publishing Committee have this in their power, have they not?

Then will they allow a hundred of us—who will be—at Cleveland, to bestow our hearty thanks upon them by decreeing:

First, No paper shall be read *by title* only; *Second*, No author shall occupy more than *twenty minutes* in reading his paper; *Third*, Papers more than twenty minutes in length must be read *in abstract.* Short papers, short speeches, and short sessions, will give the members more opportunity for social life and for comparison of notes, and will insure a successful meeting.

ARRANGED DIATOMS.—In the April number of this journal we called attention to a slide of arranged diatoms presented to the Junior Editor by Mr. T. C. Rinnbach, of Austria. Mr. W. H. Walmsley, of Philadelphia, has succeeded in making some photo-micrographs of this slide in a very successful manner. He used a Beck's $\frac{2}{3}$ds objective, allowing sixty seconds exposure, by lamplight. The print is six inches in diameter, and is certainly remarkable for flatness of field and sharp definition. The print shows 222 diatoms arranged in the most exquisite and artistic pattern. The slide is a marvel of workmanship and the print an exceedingly good one. So taking both together, many of our readers will be glad to get an unmounted copy by sending thirty-five cents to Mr. Walmsley.

THEY WILL ALL BE THERE.—The man who has nothing to say and is forever saying it; the man who could write a good paper but was terribly annoyed by a rush of professional business; the man who has attended every meeting, yet no one knows it; the man who can read his audience to sleep; the man who can't be told any thing; the man who always has poor accommodations; the man who will surely ask you for your annual dues; and, last of all, the man who tries to run a journal.

EDITORIAL NOTICES.—A "press of matter" prevents our Scientific Puzzle from devoting over eight lines to our annual meeting. By abbreviating some of the words he could possibly have saved another line. This might have been sold and the proceeds sent to Mr. Cole, of London, for purposes to be described hereafter.

SECTION OF MICROSCOPY OF THE A. A. A. S.—We are obliged to chronicle, in this connection, the coming demise of Section G., of the A. A. A. S. As is well known, this Society meets in our own city, the week following our Cleveland meeting. It is also generally understood, that Section G. will hold its last session at that time. It was weak at birth, but with careful nursing it promised well, until it took for its adopted father, one who could not live with his own kind. The newly adopted child, however, soon showed signs of relapse, and sank rapidly. A council of eminent men was held, at Philadelphia, a year ago, and the prognosis of "death at the end of another year" was

solemnly proclaimed. While this is sad, still we have left to cheer us the fact that the forsaken child commenced at once to grow and develop in the most surprising way and to-day stands in physical and intellectual development far ahead of anything of its kind ever known.

We have seen the lines on the *Amphipleura pellucida*, with a one-six objective, but never with a one-fifth. The Gundlach Optical Company are to be congratulated that the first one-fifth to do this comes from their house.

Mr. Jas. Zentmayer has removed from his old stand to No. 201 South Eleventh street. Here he will keep a full line of spectacles and eye-glasses in addition to his regular stock of Microscopes. Mr. Zentmayer has been engaged in his work over thirty years and has made a proud record for business integrity.

Mr. Woolman gives us a "special outfit" in his new advertisement that looks attractive enough. Mr. Woolman is prepared to meet all demands, it seems, from five to fifteen hundred dollars.

At the last meeting of the Central New York Microscopical Club, held June 29th, the following officers were elected for the ensuing year: President, R. ABERDEIN, M. D.; 1st Vice Pres., E. R. MAXSON, M. D.; 2d Vice Pres., A. D. PERRY; Secy. and Treas., WILL H. OLMSTED; Member of Board of Directors, ROB'T ROBOTHAM.

DAMMAR CEMENT.—Dissolve gum dammar in benzole, and add one-third of gold-size; it dries very quickly, and is preferably used as a first coat for affixing the cover-glass when glycerine is used for mounting.

GUM, for attaching labels, covering papers, and objects mounted dry (as parts of insects, foraminifera, etc.). Dissolve 2 ounces of gum arabic in 2 ounces of water, and add 2 drachms of soaked gelatine (for the solution of which the action of heat is required), 30 drops of glycerine, and a lump of camphor.

SELECTIONS.

MEASUREMENT OF BLOOD CORPUSCLES.

For some time past I have been endeavoring, for my own satisfaction, to determine whether there is a constant average size of the human red blood-corpuscles, with the view ultimately to determine whether it is possible, by means of micrometric measurements, to distinguish human blood from the blood of domestic animals.

In order that the results arrived at may be compared with those of other observers, I think it proper to state at the outset the methods and instruments employed.

The first requisite is obviously a correct standard of length, and the accurate determination of the value of the eye-piece micrometer used. This preliminary work has engaged much of my time and attention for several months past, and I have fully succeeded in obtaining two very accurate standards. The one of these which has been used as the standard of the measurments hereinafter given, consists of lines ruled by Prof. W. A. Rogers, of Cambridge, Massachusetts, (who is recognized as the highest authority upon questions of this sort) upon speculum-metal at intervals of 1-2,000 inch. The relative and absolute corrections of this standard have been determined by Prof. Rogers with very great accuracy, and the value of a division of the eye-piece micrometer described below was determined by taking an arithmatical mean of a long series of measurments of different intervals of 1-2,000 inch, so as to eliminate as nearly as possible, all errors of graduation and of measurement, and the value of one division of the micrometer was thus found to be .000,000,992,5 or approximately 1-1,000,000 inch. The stand used with mechanical stage and Abbe condenser, was made by Mr. Walter H. Bullock of this city, and is of the pattern styled by him the "Biological Stand."

The actual tube length was 8.91 inches from end of nose-piece to upper end of draw-tube.

The cob-web eye-piece micrometer used was also made by Mr. Bullock, the pitch of the screw being $\frac{1}{2}$ millimeter, and the

micrometer head being divided into 200 parts, which were read to 1-10 of a division.

The objective used was a homogeneous immersion 1-10, made by H. R. Spencer of Geneva, N. Y., having a numerical aperture of 1.35, and it was used with a Bausch & Lomb achromatic amplifier, giving an amplification of about 1,500 diameters. The immersion fluid used was Prof. Smith's new homogeneous immersion fluid, the composition of which he has not yet made public.

The blood was drawn from my finger, and a thin film spread with a needle upon the side of a cover glass from .150 to .165 of a millimeter in thickness, and examined at once, a fresh sample being used upon each occasion. It was examined with central illumination, and always under as nearly the same conditions as possible. During the first four days of the examination, I took, night and morning, about one drachm of the elixir of calisaya, iron and strychnia; during the rest of the time no drug was taken, and the conditions were nearly identical each evening. From 25 to 100 corpuscles were examined each evening and I have tabulated the results, giving the smallest, largest, and average size in millionths of an inch, of each 25 corpuscles; also the average of each 50, 75, 100, and 200, corpuscles. The corpuscles were measured large and small, as they presented themselves in the field of the microscope, the only condition being that they should be approximately circular.

An examination of the following figures shows that the difference between the greatest and smallest averages of 25 corpuscles is .000,028 or 1-35,714 inch, a magnitude that may be easily measured by any person having the requisite skill and apparatus.

The difference between the highest and lowest averages of 50 corpuscles, is .000,015 or 1-66,666 inch, which approaches more nearly the limit of micrometric measurement, though probably not beyond it.

The difference between the highest and lowest averages of 75 corpuscles is .000,012 or 1-83,333 inch, which approximates the limit of micrometric measurement.

The difference between the highest and lowest averages of 100 corpuscles is .000,009 or 1-111,111 inch, which is within the

limits of personal and instrumental error, according to the highest living authority upon this subject, who writes in substance, that it is easy to measure 1-50,000 inch, but to be sure of 1-100,000 inch, is not possible.

DATE.	Smallest.	Largest.	Average of each 25.	Average of each 50.	Average of each 75.	DATE.	Smallest.	Largest.	Average of each 25,	Average of each 50.	Average of each 75.
1885.						1885.					
June 24 9 p. m.	260	368	(1)313			July 7 8 45 p. m.	267	361	(14)312	(7)313	
June 25 8 30 p. m.	263	371	(2)319	(1)316		July 7 9 35 p, m.	273	380	(15)315		(5)313
June 26 8 p. m.	274	383	(3)335		(1)322	July 7 10 10 p. m.	284	345	(16)313	(8)314	
June 27 7 40 p. m.	270	361	(4)320	(2)327		July 9 8 p. m.	275	361	(17)315		
June 27 8 55 p m.	258	369	(5)325			July 9 3 40 p. m.	278	350	(18)312	(9)313	(6)313
June 28 8 05 p. m.	286	349	(6)316	(3)321	(2(320	July 9 9 15 p. m.	198	393	(19)317		
June 29 7 20 p. m.	286	384	(7)329			July 9 10 p. m.	274	389	(20)322	(10)319	
June 29 8 20 p. m.	279	380	(8)327	(4)328		July 11 7 20 p. m.	278	348	(21)318		(7)319
June 30 9 p. m.	274	361	(9)318		(3(325	July 11 7 53 p. m.	255	363	(22)307	(11)313	
July 2 8 25 p, m.	271	355	(10)320	(5)319		July 11 8 37 p. m.	285	358	(23)318		
July 2 9 15 p. m.	297	366	(11)329			July 11 9 36 p. m.	288	356	(24)328	(12)323	(8)318
July 2 9 45 p. m.	266	348	(12)318	(6)323	(4)322	July 17 7 45 p. m	285	349	(25)314		
July 7 8 p. m.	274	349	(13)313			July 17 8 40 p. m.	269	351	(26)312	(13)313	

Average of each 100: June 27, 7:40 p, m., ... (1)322.
" " " " " 29, 8:30 p, m.,..... (2)324.
" " " " July 2, 9:45 p, m,,..... (3)321.
" " " " " 7, 10:10 p. m.,..... (4)315.
" " " " " 9, 40 p. m.,..... (5)316.
" " " " " 11, 9:36 p. m., ... (6)318.
" " " 200: Juue 29, 3:20 p, m.,..... (1)323.
" " " " Jnly 7, 10:10 p. m,,..... (2)318.
" " " " " 11, 9:36 p. m.,..... (3)317.

Average of whole number (650)	.0003186 inch
Correction for excess of value of micrometer	.0000023
	.0003163=1-3162 inch.
Smallest corpuscle of the whole number	.000198=1-5050 "
Largest corpuscle of the whole number	.000393=1-2544 "

The conclusion to be deduced from the above figures, is obviously that when a sufficient number of corpuscles are measured, there appears to be an average size which varies within very narrow limits, which may possibly be accounted for or at least is consistent with personal and instrumental errors; for though I have carried out the figures to the sixth decimal place, I have not the presumption to declare that the result can be relied upon farther than the fifth place, and have carried out the figures to the sixth, only to insure accuracy in the fifth so far as

possible. Another conclusion is, that granting for the moment that it is possible to identify blood by measurements of the red corpuscles, of which I am by no means satisfied, it is reckless in the last degree, if not criminal, to express an opinion upon the measurment of less than 100 corpuscles. To express an opinion upon the measurement of only 10 corpuscles, as I am informed has been done in this section within the last year or two, to take the most charitable view of the subject, betrays such culpable ignorance of a subject involving such momentous consequences as ought forever to invalidate the testimony of one who should swear so recklessly. In a case involving the issue of life and death it would be better to measure several hundred corpuscles.

An examination of the unabridged table of measurements, from which the above summary is tabulated, discloses the further fact, that by selecting the corpuscles, it would be possible for a dishonest observer to make the average much larger or smaller than the above given, without the possibility of detection; a fact, the bearing of which upon the value of expert testimony upon this subject is so obvious as to need no comment.

It will be seen that I have not attempted to draw any inference as to the cause of the larger average size of the corpuscles first measured. Whether it was due or not to the drugs exhibited during the beginning of this work, is an interesting subject of inquiry, which must be reserved for future examination. I expect to continue these investigations, and at some future day will publish the results.

MARSHALL D. EWELL, M. D.

In "Chicago Legal News."

POST GRADUATE WORK.

An official circular from the Western Association of Collegiate Alumnæ, says of the paper recently given before that body by the junior editor of this journal:

"This paper not only gave information about the opportunities for post graduate work in the University of Michigan, but the opening pages presented a broad and complete discussion of the advantages to women of such work.

Mrs. Stowell proved conclusively, by facts and figures with regard to the relative large numbers prepared for the more in-

ferior positions as teachers, the truth of the old adage—"At the top there is always room"—and most eloquently plead with women to prepare themselves to ably fill the higher positions, answering the argument against the time consumed in preparation for such positions by statements showing that a woman of average ability could, by the age of twenty-five, gain the title of Doctor of Philosophy, and before that age she could not have reached the development of character for filling rightly a position which that title would enable her to obtain. Merely obtaining high degrees, however, is not what was urged, but special preparation in some one line of work; the speaker asserting that even if the only ambition of a young woman be to gain a livelihood, she would still say: "Keep to a Specialty."

She earnestly advocated, to medical graduates in particular, the importance of continuing their studies for a few years in one line of investigation, offering as a stimulus to such study the prospect of filling some of the chairs in the new medical colleges.

She stated that there should be, without question, a woman Professor of Anatomy in every medical college where women are students. Women should also be in charge of reformatory schools for girls, and there should be women physicians in all of our city hospitals, insane asylums and poor houses to treat the women in these places.

The paper closes with a tempting picture of the advantages of studying at any university center, showing how much better are the facilities for work there, and what a constant incentive is derived from the association of bright minds and how the very atmosphere of learning pervading such a place has an educating influence."

METHOD OF PREPARING PERMANENT SPECIMENS OF STAINED HUMAN BLOOD.

Dr. V. D. Harris writes as follows: Although at first sight a very simple matter, it is found in practice to be anything but easy to prepare specimens of human blood, so that the corpuscles may retain their shape and may be at the same time well stained. After the trial of a large number of different methods I recom-

mended the following as giving the most satisfactory results. The finger is pricked and a large drop of blood is allowed to exude; a perfectly clean cover-glass is lightly drawn upon the top of the drop so that a very thin layer of blood adheres, so thin as hardly to be evident until it is dry. It is then dried in the air or put at once without drying into one of the following solutions, viz. chromic acid 1-12 per cent.; bichromate of potassium 1-2 per cent.; methylated spirits or absolute alcohol for five or ten minutes, washed in water and again dried. The specimen is now ready for staining. The best dye for this purpose will be found a *recently prepared* 1 per cent. solution of Spiller's purple in water to which a few drops of alcohol have been added, or a weak spirit solution of rosein. A few drops of one or other dye having been filtered into a watch-glass, the cover-glass is placed upon the surface of the solution blood downwards, and allowed to remain so for from five to ten minutes. It is then removed, washed for some time in a gentle stream of distilled water, dried thoroughly, and mounted in Canada balsam with or without previous treatment in clove oil for a minute or two. On examination of the specimen the colored corpuscles should be found of normal shape and colored purple or red, according to the dye used, and the colorless corpuscles similarly stained. The method with Spiller's purple will be found especially useful when blood is examined in diseased conditions in which the existence of micro-organisms is suspected, and is superior to any other of the many anilin dyes (such as methyl-violet) which I have tried.

REPAIRING A NICHOL PRISM.

Nichol prisms which have become scratched and dull may be restored to usefulness by cementing a thin cover-glass over the ends with clarified gum-damar. The prisms should first be carefully cleaned by scrubbing with a very soft brush and soap, to which may be added a little precipitated chalk. They should then be rinsed with distilled water and carefully dried, pains being taken to remove every particle of dust and dirt from within the scratches. The cover-glass, which should be thin and perfectly clean, should then be applied in the usual way, exactly

as in making a balsam mount. When carefully done, not a vestige of the scratches can afterwards be detected. A large and costly prism belonging to an instrument of mine, having been badly scratched by the careless handling of a student, was sent to a local lapidary, who repolished it. On the return of the prism from the hands of the polisher, I found that its optical properties had been sadly interferred with from the fact that in the process of polishing the surface had been cut away more at some points than at others, thus causing it to give a distorted image of objects regarded through it. By resorting to the above process, however, and cementing a cover-glass to each end, I found that its pristine virtues were restored, and that it now works as well as it ever did.

A MODIFIED METHOD OF STAINING THE BACILLUS TUBERCULOSIS.

According to the Deutsche Militair-Aerztliche Zeitung the following method of staining the bacillus is taught the medical officers of the army in the courses of instruction at Bonn.

1. A whitish particle is selected from the sputum and spread in a thin film between two cover-glasses; these are then separated and the films are allowed to dry.

2. Aniline-water is prepared as follows: A test-tube is half filled with water and so much aniline-oil added as will just fill the concave bottom of the tube. This mixture is vigorously shaken and filtered through a moist filter. A quantity of this filtrum is poured into a watch-glass and thereto are added eight to ten drops of a concentrated alcoholic solution of fuchsin or of methyl-violet or gentiana-violet.

3. The dry film of sputum is then drawn through an alcohol flame, the glass being held by forceps, about four times with moderate velocity. The glass is then floated film-side down upon the solution above described. This is heated to a point of heat at which steam-vapor is liberated for about half a minute.

4. The specimen is then washed in water and immersed in muriate of alcohol (one part of chemically pure muriatic acid to one-hundred parts of 90 per cent. alcohol) for one-half to one minute.

5. The specimen is then again washed in water and after becoming dry may be mounted in glycerine or Canada-balsam. The bacilli alone are stained. By way of contrast the ground may be stained with an aqueous solution of malachit-green if fuchsin has been employed, or with Bismarck-brown (vesuvin) if a violet dye has been employed. Then after washing and drying the specimen may be mounted as above described.

An amplification of 400-500 is sufficient for examination. No immersion-lens or Abbe's condenser is needed. The advantage of the method over that of Ehrlich consists in the substitution of muriate of alcohol for nitric acid.

A much simpler method that we have tried repeatedly and have found to work satisfactorily is that of Baumgarten, of Kœnighsberg, described in Birch-Hirschfeld's Pathological Anatomy.

The dry film, prepared as above shown, is stained by an alcoholic solution of methyl-blue; after washing in water the preparation is immersed in Liquor Kali caustici. Thereby the bacilli of tuberculosis are instantaneously discolorized; all other micro-organisms and the ground remain stained. The specific bacilli appear as hyaline rods.—*Western Medical Review.*

ARRANGEMENT OF WORK-TABLE

Rapidity and excellence of workmanship in mounting, as in almost everything else of a mechanical nature, depends somewhat on natural aptitude, but more on the proper and convenient arrangement of instruments and facilities, so that no time is lost in putting the hand directly upon the desired instrument or object. These, it is presupposed, are always kept in a proper condition—the knives, needles, and scissors sharp and clean, the cover-glasses and slips thoroughly clean and conveniently arranged, the wash-bottle filled with clean distilled water, etc. Directly in front of the operator sits his reflecting box; to the left of which and close by is the bottle of cement. In front of the reflecting box, but placed so that it will not interfere with the light, is the vessel containing the objects to be mounted. To the right is the case containing the slips, ringed

and ready for use, the cement being dry and hard, and the glass clean. Near by, in convenient reaching distance, is the glycerine bottle, the wash bottle, a saucer of clean, distilled water, in which rests a camel's hair pencil, the little box of drying papers and other conveniences, among which I should mention cloths for wiping slides and cover-glasses, dryers, and cleaners, and a piece of soft chamois for giving a final polish to the slips. Everything being in readiness, we can now proceed to work.—*F. L. James, in the National Druggist.*

REVIEWS.

THE CENTURY.

This interesting journal for August is at hand and contains much interesting matter. Gen. Fitz John Porter describes "The last of the seven days' battles," and others contribute under "Recollections of a private," and "Memoranda of the civil war." There is a full page illustration of William Lloyd Garrison, with a sketch of his life. W. D. Howells, Henry James, Ernest Whitney, and Thomas Wentworth Higginson are among the contributors.

THE NATIONAL DRUGGIST.

Dr. F. L. James still pushes the microscopical department of this weekly. He has just completed his series of articles on "Elementary Microscopical Technology," and now commences a series of subjects requiring special technological handling. Any body, with reasonable care, and attention to his rules, ought to make a good and artistic mount, even with the use of White Zinc.

NERVE ENDINGS IN MUSCLE.

Dr. Chr. Sihler gives, in this pamphlet, a result of his researches on the endings of the motor nerves in the voluntary muscles of the frog. It is illustrated with a full-page colored lithograph of many figures.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

FOR EXCHANGE—Mammoth Atlas of Human Anatomy, 45 parts, unbound, by Drs. Vesterreigher and Erdl. Cost me $33.75. Will exchange for $20 worth of accessories or objectives.
DR. C. H. LOVEWELL, Englewood, Ill.

FOR SALE—Microscopic stains of all kinds, 10 cts. per oz. Also, injecting and hardening fluids, and Leibeis Carmine gelative $1.00 per oz. Address,
RUSSELL ELLIOT, P. O. box 1216, Bradford, Pa.

FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

FOR EXCHANGE—Eleven varieties of unmounted starches (including Calabar Beans, Ginger, Calchicum, Tous les Mois, etc.,) for one mounted slide objects pertaining to vegetable histology preferred. C. F. BOOTH, 278 Greenwich St. N. Y. City.

FOR SALE—or exchange Pollen or slides of the same—Double stained vegetable sections or slides of the same. J. B. BECK, Liberty, Tioga Co., Pa.

SEEDS of Orttlocarpus Purpurasceus and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well cleaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED—Microscope stand and microscopical books and journals. Will give various articles or cash for same, Send for list. C. VON EIFF, Jr. 347 Greenwich St., New York City.

FOR EXCHANGE—A good refracting telescope 2¼ in. operture which will resolve Epsilon Lyra with half inch eye piece—value $65, will exchange for a first-class Bausch & Lomb objective.
J. E, WHITNEY, Rochester, N. Y.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg. Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

WILL exchange mounted slides of various minerals (native crystals), and others, for well mounted slides. WILL H. OLMSTED, Syracuse, N. Y.

EXCHANGE.—Parties having diatomaceous earths or other microscopical material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow. Msss.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

HISTOLOGICAL SLIDES, very thin and evenly cut, well mounted and well ringed, will be exchanged for Pathological or Histological slides only.
H. L. WHITNEY, M.D., German Hospital, Philadelphia, Pa.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

FOR SALE.—Slides, double stained, of Bacillus Tuberculosis, 50c. each.
DR. W. R. CHITTICK, 83 Lafayette Avenue, Detroit, Mich.

WANTED.—Books treating on microscopical and histological subjects not already in my possession. Will pay cash, or give slides in exchange. State name of the work, date of issue, and price. C. H. STOWELL, Ann Arbor, Mich.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

PATHOLOGICAL, Histological, and other well mounted slides will be exchanged for mounted specimens of interest. Lists furnished on application.
D. E. HAAG, M.D,, Liberty Center, Henry County, Ohio.

THE MICROSCOPE.

VOL. V. ANN ARBOR, SEPTEMBER, 1885. No. 9.

ORIGINAL COMMUNICATIONS.

THE AMERICAN SOCIETY OF MICROSCOPISTS.

REPORTED FOR THIS JOURNAL BY DR. S. M. MOSGROVE, URBANA, OHIO.

THE American Society began its Ninth Annual Meeting by an address of welcome from the President of the local Microscopical Society, Mr. C. M. Vorce. He was followed by a few words from the Mayor of the city, Mr. G. W. Gardner. In response, Prof. H. L. Smith, as President of the Society, said he wished to thank the speakers for their words of welcome. "We come from all sections of the country to your beautiful city, than which no more appropriate place of meeting could be chosen. Fifty years have passed since my first visit to Cleveland. There existed then for those days a palatial hotel kept by Mr. Scoville. At that time Ohio City on the west bank of the river was the ambitious rival of Cleveland, and bade fair to overshadow her glories. I look in vain for some of the old landmarks that then existed. They have been swept away with the flight of time and others have taken their places. At that time there existed here a building called the ark, not because it resembled Noah's ship nor because there were gathered there all sorts and kinds of creatures, but because there were assembled there the scientific and literary men of Cleveland, young men full of ambition. Well do I remember their first microscope. They thought it a wonderful instrument. Then they got a more wonderful one, but even that was far inferior to what we now have. We come to your city, not as politicians seeking office nor as theologians, but as seekers after the truth."

Prayer was offered by the Rev. Jabez Hall.

The first paper of general interest was by Dr. F. L. James, of St. Louis, on

"SHRINKAGE OF CEMENT CELLS,

The Cause of Leakage in Glycerine Mounts."

We clip the following account of this paper from *The National Druggist:* "Dr. James stated that all of the cements usually used by microscopists for cell building, with but few exceptions, consist of some gummy or resinous substance dissolved in a volatile medium, consistency being given to the solution by the admixture of some solid pulverulent matter. A typical cement of this description, and the best of all cements for general purposes in cell building, is that known as white zinc cement, which is made by dissolving gum damar in benzol and adding pure ozide of zinc to the solution. When this cement is properly made at least 50 per cent. of the entire bulk of the fluid should consist of zinc oxide, 10 to 15 per cent. of the damar gum and the balance, from 35 to 40 per cent. of volatile benzol. It is manifest that such a liquid, on exposure, would lose benzol by evaporation, and that this loss would affect the bulk and dimensions of any cell built with it. Dr. James had devised a very simple instrument for making visible the extent of the shrinkage through which a cell built of this material passes in drying, but which he did not have ready for exhibition. He, however, made a blackboard drawing of the instrument and explained its method of action to the society.

With these facts staring them in the face there are men engaged in microscopical technological work who reason on cause and effect so little that they are in the habit of making cells of white zinc cement, filling them with incompressible materials, and sealing them up in their fresh and unshrunken state. When the inevitable result of such a proceeding comes, as it always does, and the incompressible fluid, subjected to the pressure of the shrinking cell walls, forces its way out of them and escapes, they are astonished and wonder "why it is that glycerine always will creep," or get angry and damn white zinc cement as being utterly unreliable. But just as it is usually the poor mechanic who complains of his tools, so it is the thoughtless and unreasoning technologist or experimenter who fails to get satis-

factory results in matters of this sort requiring a little manipulative skill mixed with a modicum of common sense. The remedy is a plain one, and lies within the reach of every one of you who have met with these disappointments. Look to it first that you have a good cement. It will not answer to proceed as one gentleman told me he had done in making zinc cement, and which, though it looked all right, was of no account as a cement. He put "a dime's worth of white zinc and a dime's worth of damar into about a quarter's worth of benzol and shook them up together until the damar was dissolved." You must take pure, dry zinc ozide—and to make sure it is dry you had better heat it in a muffle for a little while, and rub it up with damar dissolved in benzol in definite proportions. When finished there should be about as much zinc as there is of the damar solution. Make your cells with this, and let them dry thoroughly before using them. How long should they dry? You can set no fixed time. The period will vary according to the thickness and size of the cell, the weather, and the season of the year. The benzol evaporates much faster in hot, dry weather than in rainy or cold weather. They should be left until the thumb nail pressed upon the edge of the cell leaves no indentation. Try this plan once, and my word for it you will have no cause to complain of leakage or creeping of glycerine.

Dr. Stowell said that he desired to indorse every word that Dr. James had uttered. He believed that zinc cement was the best cement ever devised, and the only one that should be used with glycerine. Some might ask why use glycerine at all. He would answer, because that for certain kinds of histological work it has no equal. If the cells are built with zinc cement, and allowed to dry thoroughly, as Dr. James suggests, there will be no complaint on the score of leakage or creeping. Mr. Cole, of London, whose slides are peerless, uses nothing but zinc cement. Mr. Walmsley, of whose mounts the society was abundantly able to judge, since some of them are in every cabinet, and are unequaled in beauty of finish and durability, uses nothing but zinc cement.

Mr. Walmsley desired to be put on record as indorsing all that Dr. James had said. He had used the cement, made as

Dr. James had described, for many years, and wanted nothing better.

Dr. James exhibited some slides finished with zinc cement, and they were passed around for examination. All who saw them declared them to be the perfection of the art of mounting, and congratulated the doctor on his success with so refractory a medium as glycerine."

Ex-Governor J. D. Cox followed with a paper on

"ACTINIC AND VISUAL FOCI IN PHOTO MICROGRAPHY WITH HIGH POWERS."

This paper cannot be fairly reported without the illustrations that accompanied it. The question was how to devise a more exact and scientific method to determine the difference between the focal length at which a sharp image is presented to the human eye and that at which a clear photographic image is produced.

In this connection arose the question whether this subject dealt with "photo-micrography" or "micro-photography."

Mr. Walmsley quoted Worcester as giving a clear definition between the two terms; the prints illustrating the paper being, according to this authority, "photomicrographs." [See article under "Editorial Notes."—ED.]

Dr. Newcomer said it was formerly a test of a man's sobriety to ask him to say "National Intelligencer;" but if he had taken even a single glass of wine it would certainly embarrass him to say "photo-micrography," hence he should favor the latter term.

Dr. Stowell then moved that the society adjourn and immediately hold a special session, to take action on THE DEATH OF DR. THAD. S. UP DE GRAFF. The doctor then spoke feelingly of the loss of this valuable member to the society, and said that "although we have been arrayed against each other on many points in science, yet I have ever found him generous and hearty."

Dr. Fell and others followed in tender words of regret for this personal and public loss.

General Cox called the evening meeting to order and introduced President Smith as "one who for a generation has been a

recognized leader in Europe and America in an important department of science." Prof. Smith then delivered a most finished address, of which the following extracts will convey only a faint idea:

PRESIDENT SMITH'S ADDRESS.

I wish that somebody else might have been selected to give you the history of what has been done in microscopy the past year. While in a general way I may touch upon that subject I shall take as my theme THE UNCONSCIOUS INFLUENCE OF NATURAL SCIENCE STUDY ON THE DEVELOPMENT OF SOCIETY. We are apt to lose sight of those quiet influences which are affecting our social life. The speaker then, in the course of his address, likened the progress of this influence to the steady movement of the world. Cyclones and tempests may claim all our attention for a time but the round world keeps on in its course undisturbed by those influences. Happily, we, in the study of microscopy, are untrammeled by metaphysical thoughts. We microscopists do not trouble ourselves with cause and effect, but leave the leaven in the lump, feeling assured that it will in time leaven the whole. The old world has passed away. The age of the hero has passed away. The people have arrived. Science has arrived, and theology, law and all are on trial. Those who devote their lives to scientific research develop a love for truth. Do not think that I claim that the study of nature is all, however. There are men who look upon the scientific man as one who must snap, snarl and sneer, and that where science appears religion must retire. It is a real relief to turn aside from this distrust to men who have made ears dull with pain hear the sweet music of nature. In discussing the depreciation of labor, and the tyranny of office, men have often, in offering remedies, put in motion forces which, if uncontrolled, would have done more harm than good. The plans for the absorption of railroads and telegraphs by the government are miserable failures. We must solve the difficulties that confront us with some other power. We must have a unification of nations in the good work, and this is already shadowed in a universal system of time and of weights and measures.

A civilization based on science cannot so revert. Our trustworthy hopes for a glorious future are based on scientific research. No one is more to be pitied than the pessimist and ag-

nostic. We, as students of nature, are not dependent upon metaphysics but find at our doors constantly the evidence of the truth.

Mr. Smith hinted at the great work already accomplished by the study of science which has resulted in the ocean cable and other inventions having a bearing on our comfort and progress. He said that he presumed that all the members of his society are believers in the Darwinian theory, and spoke of the evidences of development as shown in a pure tone from the pulpit and other things from the forum and the exchange. It was far from his purpose, he said, to urge a further study of science in the schools and more science from the pulpit. All this will come in time. Such a student as he who discovered the influence of the electric current on the magnetic needle has done more for the world than the demagogue who struts his brief time on the stage of human existence and then disappears. That quiet discovery by a Copenhagen student has had an immense influence on all branches of industry from the telegraph to electro-plating.

The speaker referred satirically to those good old days when men grew old before their time, when geologists were considered akin to infidels, when the divine right of kings was believed in and the luxuries which we now enjoy were unknown. It is quite the fashion to rave about those good old times, but we would not want them back again. We would scarcely give up our railroads and telegraphs and our table luxuries, now necessities, for the good old times. As we look upon the luxury of the present as compared with the past we may ask, "How did our grandmothers live?" They did not live, growing old as they did before their time, but they were comparatively far advanced beyond what their ancestors were. Every gathering like the present has its benefit in human progress. We sometimes hear of conflict between science and religion, but it is only apparent. It was but a few years ago when good men looked upon geology as akin to infidelity, forgetting that astronomy had at one time been considered equally dangerous, but had come to be recognized as attesting the glory of God. So in time geology has become recognized as not in conflict with true religion. Professor Smith said that he could remember when physicians were shy of the microscope. To-day, while there are a few old prac-

titioners who shrug their shoulders distrustfully when the younger physicians use the microscope, even the old ones are unconsciously affected in their practice by advancement in microscopical investigations. The president spoke of

BIOLOGY,

which owed its existence to microscopy and which has worked a revolution in medicine. Anything that can claim to aid us in coping with contagious diseases, with blights upon our crops and diseases of our flocks is of intense interest to the public, and it is with these that biology deals. It is in its infancy yet, but it is destined to become more and more important. The speaker said that it had been shown that the two hundred millionth part of a drop contains enough bacteria to be deadly infectious. He said that when it is shown that ventilation and sewage have been greatly benefitted by microscopical investigations it may be considered fortunate that some men have microbes on the brain as has been said in jest. He said that biology may yet prove that the infinitesimal organisms in which it deals are not alone concerned with diseases but with health as well and that they, acting in the pores of the human system as workers, carry off the sewage of the system and thus overcome the effects of violations of nature's laws, and thus work to the end of aiding man in working out in himself the theory of

THE SURVIVAL OF THE FITTEST.

He said that microscopy has a great work to do in geology, and thus in affecting the commerce of the world. It has been said, "Make it unfashionable for men to drink and gamble, and our sons will stay away from the saloon and gambling hell." Fashion cannot be compared in its force with the influence of science studies on man. The hod carrier, who climbs the ladder with his burden, is better and happier for that which has been accomplished by scientific research which, with its electric lights and telephones, have done so much to lift him out of the ditch in which his fathers were.

The professor did not claim everything for scientific research, but likened it to the carefully made balance wheel in the chronometer which, although but a part of the delicate machinery, is an essential part. He closed with an elegant bit

of composition, and at the finish of his address a unanimous vote of thanks was given him by his hearers, visitors as well as members of the society.

Dr. Detmer, of Champaign, Ill., read a paper on

POISONOUS DRIED BEEF.

In it the writer related his experience in Chicago in the detection of poisons in meats of different kinds. He spoke of one case of wholesale poisoning which occurred in Illinois, resulting, as was afterwards discovered, from dried beef procured at one of the Chicago markets. He referred to his investigation in the Chicago stock yards, among the cattle killed there, in an attempt to discover the causes of various poisons in animal food. As the result of his examination, Dr. Detmer came to the conclusion that the animal or animals from which the beef was taken must have either been injured by being trampeled upon in the cars, and butchered when in a dying condition, or killed while in a frenzied state. In the case of a deer chased to death by dogs, poison has been found in the venison. Dr. Detmer alluded to the Chicago health officers and the carelessness which they were guilty of in allowing cattle that had been trampled to death in cars and in yards to be killed and the beef put on the market and distributed throughout the country. Of ten thousand hogs that Dr. Detmer examined, nearly 5 per cent. were found to be affected with trichina. The Doctor urged the necessity of greater care by officers whose duty it is to examine into these matters, and who are clothed with sufficient power to protect the public from unhealthy beef. He strongly advocated the burying of all dead animals to remove the danger of contagion. The Doctor exhibited photo-micrographs of the bacilli which constitutes the particular poison in the dried beef referred to.

Prof. H. L. Smith then gave a paper on

"SOME FORMULAS FOR HIGHLY REFRACTING MEDIA FOR MOUNTING MICROSCOPIC OBJECTS."

The following directions were given for preparing this medium which Prof. Smith assures us will stand the test of time.

"PROF. H. L. SMITH'S CLEAR MEDIUM."

Dissolve Gelatin in Glycerine, till when cold, it is quite

viscid, (not as solid though as Glycerine Jelly). If both preparations were clean, they do not need filtering. In two drachms of this dissolve forty *grams* of "Stannus Chloride"—This will dissolve cold. Now put it in a test tube, not more than one-third full, and boil vigorously, when the solution clears up, and if thought necessary can be filtered. It is then about as viscid as old Balsam and is ready for use. It is used as follows:

Put a small drop on slide (less than you would use of Balsam) add the cover with Diatoms burned on it. Then holding slide over lamp boil vigorously. The cover is now tightly adherent, and the excess of fluid can be chipped off around cover, and cleaned with Hydro-chloric Acid which dissolves it immediately. The mount is thus made; but inasmuch as the Gelatin is deliquescent, it is better to put on a ring of wax or shellac cement which affords the needed protection.

The Homogeneous Immersion Fluid for use with objectives is made the same way as above only do not use so much Stannus Chloride—add only sufficient to bring refractive Index to 1.52.

Dr. Detmers, of Champaign, Ill., in a short speech, called attention to the important aid which might be rendered to the society by means of A QUARTERLY PUBLICATION, which should be devoted to the microscope and its uses. He said he had attempted to start such a paper in Chicago, but so far without success. He felt that the society should take some action in the matter, and for that reason offered the following resolution:—

Resolved, That a committee be appointed by the chair to report on the advisability of the publication of a quarterly microscopical journal, to be published by the American Society of Microscopists.

The resolution was put to vote with scarcely no discussion and was lost by a decisive vote.

Prof. Gage, of Cornell University, read two papers on

"NOTES ON THE BLOOD CORPUSCLES OF NECTURUS," and "NOTES ON THE EPITHELIUM OF THE MOUTH OF NECTURUS."

In these papers the author stated he had seen the so-called intra-cellular and intra-nuclear network of Heitzmann. This provoked a very animated speech from Prof. Stowell, whose views are well known on that subject.

Prof. J. D. Cox read a paper on

"SOME DIATOM HOOPS AND THE QUESTION OF THEIR MODE OF GROWTH."

Mr. Cox explained for the benefit of those unfamiliar with diatoms, that they are botanically known as "unicellular algæ," which secrete silexin the covering membrane, until they become glass boxes of minute proportions, filled with the live contents common to vegetable structures. But this inflexible box makes the matter of growth a problem having its own difficulty. The diatom follows the mode known as fissural division, in which the shell contents divides into two, forming two new cells which grow to the size of the parent. This again implies the enlargement of the whole mass to double the former size, and the newly demanded space is furnished by the sliding of the valves upon each other teloscopically. The sliding parts are called the hoops. This introduction leads to the points aimed at in the paper. A beautiful diatom was described, a disc form ornamented by a peculiar cross-shaped arrangement of dots or cellules. Between the two valves which form the box the hoops intervene. In this species these hoops are clear and transparent, but are in rings separated by sutures, at which they readily separate when ripe. These sutures are so shaped that in each ring is a tooth pointing toward the valve to which the ring is attached. When separated at the sutures each ring is a band with a boldly-projecting tooth on one side, but interrupted at the extremities, so that it is not a complete ring, but a bent band, with the ends approaching each other. The paper then took up the question of the mode of the growth of these rings, saying that the prevalent theory has been that they grew at the edges. Mr. Cox, however, maintained that these sliding hoops do not grow at the free edge, but that they are formed as a membrane directly from the live contents of the single cell, and upon its surface. This view was supported by various arguments.

After the usual vote of thanks, and after a few well chosen words from the new President-elect, the society adjourned *sine die*.

The above brief report conveys but a slight idea of the character of the papers presented, or of the enthusiasm awakened.

Over fifty new members were elected, and there were nearly 200 members in attendance.

The number of papers presented was very large and of such a character as to insure a most desirable volume of proceedings.

THE WORKING SESSION.

W. P. MANTON, M. D., DETROIT, MICH.

ONE of the most interesting and successful features of the programme of the late meeting at Cleveland was the *Working Session*, which was held in Le Grand Rink on Euclid avenue, Thursday afternoon, Aug. 20th.

As regards light, air, and working-space, no better place could have been selected; and the entire management and arrangement of the Session reflects great credit upon the director, Mr. C. M. Vorce—whose untiring efforts to make it a success were crowned with the most satisfactory results.

This working session—the only really practical part of the meeting—is of greater benefit to the society than is usually recognized; for here, not only is it the business of the hour to exchange ideas and "experiences," but in so doing a more general acquaintance and kindly feeling results, which tends to knit the members together into a more sympathetic body.

Nor does this session lose in interest by repetition, since each year new methods are discovered or old ones improved, microscopical accessories and materials devised, and new men, many of whom had the advantage of foreign study in this line of research, added to the ranks of the workers.

In the limited space at our disposal it would be quite absurd for us to attempt to remark upon the work done at each of the 38 or more tables scattered about the rink, but a glance at the schedule would at once convince the most sceptical that the material offered was of a high class, and instructive.

Among the novelties this year were the new microtomes of Messrs. Bausch and Lomb and W. H. Bulloch. These have all sprung from the same source, viz: the Schanze microtome (Leipsic) exhibited at the meeting at Rochester last year. The original instrument, as will be seen by the programme, was again shown, and its fine work and action were all the more marked from the fact that the following three tables (18-19-20) were oc-

cupied by the microtomes of American make—imitations of the former, with such modifications and improvements as have been suggested by the fertile and ingenious native mind. It appeared to us that while the instruments of B. and L. worked in the main well, their action was too stiff, too great effort being required to move the knife.

Bullock's microtome seems to combine many advantages; but for some reason the knife was unsteady, and as a consequence could do work not much finer than the old-fashioned hand instrument. It is greatly to be hoped that these faults may be corrected during the coming year, so that at our next meeting the American may stand abreast, or even excel, the foreign instrument.

In this connection we may mention the ingenious freezing microtome devised by Dr. F. O. Jacobs (table 21). This consists of two copper cans, one within the other, and in the center of the smaller a thick copper rod. The cans are fitted with tight covers, both pierced by an opening for the rod, which is stationary, the table working up and down on a screw having 30 (?) threads to the inch. The cans are filled with alternate layers of pounded ice and salt, covered with water. Freezing begins almost immediately, and any tissue placed upon the rod is sufficiently hard for cutting in from 15 to 20 minutes. Specimens may be kept frozen by the instrument for four or more hours.

Another demonstration to which attention should be called was that of Prof. Burrill. In these days when bacteria, bacilli, etc., play so important a role in the diseases to which flesh is heir, it is interesting to know that vegetable life is also subject to analogous conditions. That these vegetable germs are as capable of cultivation as B. Tuberculosis or B. Anthracis, etc., was ably shown by Mr. Burrill.

The *electric light* so extensively used in all departments of science has now been introduced in microscopy (table 26), but, as now arranged, will scarcely meet the requirements of the majority of workers, as the expense, trouble, cumbersomeness of the battery, etc., will hardly place its value as an illuminator above that of the ordinary oil lamp.

We might thus go on through the whole well planned and interesting programme; but enough has already been said to show the merits and uses of the working session.

THE MOTION OF DIATOMS.

C. OUDERDONK, RUGBY, TENN.

HAVING studied the Diatomaceæ for a few years mainly in regard to a discovery of their mode of motion, I have a few suggestions to offer my co-workers, if so be, they are found worthy a place in your journal.

In studying the phenomena of the motion of those organs it became obvious to me that the motion could not be caused by cilia, nor by the flow of water in and out of the frustule. The following facts became clearly established by continuous observation, viz: The motion is on the outside of the valves; it is from end to end, or with the long axis of the organism; it is rythmic, the motion is reversed at intervals; it is not of the nature of swimming, hence there can be no propelling organs in the form of fins or motile cilia; the diatomaceæ can only move when they come in contact with some substance more firm than themselves, if the contact is with lighter particles, the particles are moved, not the diatoms; and further, the best glasses made fail to show a trace of motile organs. This last fact is significant, for it must be apparent to the thinking mind that organs of whatever nature, large enough to move a large pinularia, must, in the nature of things, appear under a good wide-angled glass.

In view of the facts enumerated I said there is a fluid in motion on the outer surface of the valves, no other supposition will account for the observed phenomena. So I turned my attention to the discovery of the fluid, or semi-fluid.

I turned my attention to the Palmellaceæ. Here I had an invisible frond, firm enough to be lifted out of the water and hold the green globular masses contained in it. I began to search for stains to make this invisible matter visible. I found that methyl analine green stained the palmella a clear blue, while it also hardened it. I found that this stain also stained the living diatoms blue; more than this my success was far beyond what I had hoped for, for I saw in many cases a blue mantle slowly unfold and detach itself from the now white, denuded frustule. Subsequently, by many observations, I have found that all diatoms which have come under my notice are encased in a gelatinous pallium; that this pallium is most manifest under the action

of the stain, in the case of the diatoms with strong motion, and least manifest in the case of fixed diatoms like those with stipes; that the diatomaceæ have no internal motion analogous to the motion called cyclosis in the Desmidaceæ; that the motion on the outside of the outer covering of the Diatomaceæ is strongly analogous to the motion on the inside of the outer covering of the Desmidaceæ.

From the above mentioned facts and others which time forbids to mention, I offer as a theory that the motion of the diatomaceæ is caused by what I will call *external cyclosis*. I do not court credence, (an editor of a journal in the cause of microscopy objected to my papers on the ground that I could not expect to gain credence), I only trust microscopists will investigate; if my theory is false, let it fall.

[The author of this paper wishes it stated that he uses a Gundlach 1-5 of 135°, and Gundlach $\frac{1}{8}$ Im. 140° N. A., with an amplification to 2,500 diameter. His investigations, he says, have extended upwards of five years.—ED.]

Just after our August issue had gone to press we learned of the death of Dr. Thad. S. Up de Graff, of Elmira, N. Y. In our next issue Dr. Lewis M. Eastman, of Baltimore, will contribute a paper on his life and work.

During the past two months we have been enjoying a vacation from the more active duties of college life. Some of our correspondents are aware of this, we fear, because of neglect on our part to reply to their queries or correct some oversight in our mailing list. We desire that all our subscribers should feel well satisfied with us, and if the journal fails to reach you, or if it comes in a damaged condition, just let us know and the error will be corrected if possible.

Mr. H. H. Turner represented the Gundlach Optical Co. at Cleveland and exhibited, principally, some of the new lenses of Mr. Gundlach. These always excite great interest among all advanced workers.

EDITORIAL NOTES.

PERSONAL NOTES AT CLEVELAND.—Some of us have never had the privilege of meeting the older representatives of our American work until within a very few years. Hence it is that at this late date we call attention to one whose charming manners captivate all the younger members. Our President, Prof. H. L. Smith, holds our attention not only by his recognized authority on microscopical matters, but also by his clear and concise way of putting things. May he meet with us for many years to come.

PROF. T. J. BURRILL is a man about 45 years of age, and apparently in the best of health. For some years, Prof. Burrill was principal of the city schools at Urbana, Ill. In 1867, he was the botanist on Major Powell's first Rocky Mountain exploring expedition. In 1868, he was appointed Professor of Botany in the University of Illinois, which position he still holds. Prof. Burrill has paid special attention to cryptogamic botany, especially the fungi. He has published numerous papers on various fungi, in scientific periodicals and in transactions of societies. In 1880, he proved by inoculations that the disease called "pear blight" and the blight of apples is due to bacteria —the first plant disease known to be caused by these organisms. In 1883, he issued a pamphlet describing all known species of bacteria, several new by the author. This year he has issued a work of 115 pages on the parasitic fungi of Illinois. Prof. Burrill is also Vice-president of Section F, of the A. A. A. S. and Vice-president of the University of Illinois.

DR. JAMES, of St. Louis, was in direct contrast to our Scientific Puzzle at Washington, "who," says The National Druggist, "was conspicuous by his absence." The doctor makes himself known and felt wherever he goes.

MR. BULLOCH, of Chicago, generally knows what he goes after, hence the surprise when he asked for some "kerosene," and was told there was none in the city. The store-keepers had "illuminating oil," "Standard oil," etc., but not one knew what "kerosene" was.

DR. H. J. DETMERS keeps a sharp lookout for weak points

in papers and new methods of work. The doctor states his positions clearly and forcibly and no one can mistake his meaning. His special work on bacteria, his photomicrographs of the same, and his work on adulteration of foods, will stand the test of time.

DR. A. Y. MOORE is not as fleshy as we would like to see him, but we do not believe he has his superior in this country in geting out of an objective that which it is capable of showing.

MR. C. M. VORCE, of Cleveland, is certainly able to do hard executive work, but he must confess he has a superior in his own house when we consider the question of such a delightful entertainment as a number of us enjoyed at his beautiful home.

DR. S. O. GLEASON charms all who listen to his words. It is a pleasure indeed to have him with us. Although his years are many, and his hair is white, yet his eye is keen and his heart is light.

The following are the officers elected for the ensuing year: President, Prof. T. J. Burrill; Vice-Presidents, Dr. F. S. Newcomer, Dr. W. J. Lewis; Executive Committee, Dr. F. L. James, John Kruttschnitt, E. H. Griffith.

THE CLEVELAND MEETING.—It requires but a word to inform our readers that this eighth annual meeting was a decided success. The very best of harmony prevailed from first to last, and all parties seemed to enjoy themselves. The papers were of an unusually interesting character, and some of them of vast importance to the progress of science. Over fifty new members were added to the list and the attendance of the regular members was as large as at any previous meeting.

IS IT A MICRO-PHOTOGRAPH OR A PHOTO-MICROGRAPH? The "Imperial Dictionary," published by the Century Co. last year, says under "Microphotography": "A photographic process by which an object is diminished in size, and yet its exact form retained." It then gives as an instance of this, the well-known method adopted during the siege of Paris in 1870, when communication was carried on by letters reduced to the minimum of space. This is also given as a simple word. Under "Photomicrography" it says: "The art or process of enlarging minute objects by means of the microscope, and projecting the enlarged

image on a sensitized collodion film." This is given as a compound word. Worcester gives practically the same definitions. It is proper then for Prof. Cox and Mr. Walmsley to show us their *Photo-Micrographs*, while Mr. Ayres, of Jamestown, N. Y., shows us his *Microphotographs*.

MICROPHOTOGRAPHS. This calls to mind the beautiful specimens of work in this line that Mr. Ayres exhibited at Cleveland. He has some of the most charming charms we have ever seen. His work is superb and many of our readers, we are sure, will avail themselves of the opportunity he offers in our advertising pages, and will allow him to make microscopical specimens of themselves.

PHOTOGRAPH OF THE AMERICAN SOCIETY. Mr. Ryder, of Cleveland, has forwarded us two prints from the negatives taken at Lakeside, and to those familiar with the beautiful work of this artist it is only necessary to say that it fairly represents his acknowledged skill in this branch of work. The larger print is 8×15 and neatly mounted. There are seventy-four members in the group and each face is clear and well defined. The smaller print is 4×8 and is also sharp and clear. Still the larger print is to be preferred, if a good view of each of the faces is desired. The larger prints, well mounted, can be obtained for one dollar each, with ten cents extra for packing; the smaller ones for thirty cents each. Parties should address J. F. Ryder, 239 Superior St., Cleveland, Ohio.

EXHIBITS AT CLEVELAND.—There was a fine display of Microscopical goods by several dealers and the members took advantage of this in many ways.

Mr. Walmsley exhibited a few microscopes, including the new "Star" pattern. He gave his special attention, however, to his new photographing apparatus and took a number of orders for the same. It is, in our opinion, the best pattern in the market.

Messrs. Bausch & Lomb had a full line of their goods on hand, and made a most brilliant display. Especial attention seemed to center around their "Physician's" and "Universal" stands, while a host of accessories came in for their share.

W. H. Bullock's table was well surrounded with persons

admiring his fine brass work, and now and then trying their skill by working his automatic microtomes. These excited a good deal of interest, as did his new eye-piece micrometers.

Herbert Spencer was there with some of his superb glasses; good lenses in anybody's hands, but doubly so when Mr. Spencer can manipulate them. Why is it he does the thing so easily and in such a simple way?

Mr. E. Pennock represented Queen & Co., with a full line of their goods.

SELECTIONS.

THE EPITHELIUM LINING THE MOUTH OF NECTURUS AND MENOPOMA.

SIMON H. GAGE, CORNELL UNIVERSITY.

In frogs, as is well known, a lining of ciliated ephithelium covers the free surface of the mucous membrane of the mouth and œsophagus, and extends to or into the stomach. This is true also of a great many other Amphibia, and the generalization is made by Wiederscheim, (Lehrbuch der Vergleichenden Anatomie der Wirbel thiere, Band II., page 583) and by Hoffmann, in the part Amphibia of Bronn's Klassen und Ordnung der Thier-Reichs (p. 383), that a ciliated epithelium lines the mouth and œsophagus of all Amphibia. (That is, frogs, toads and salamanders of all kinds).* Hoffmann, citing Leydig as Authority, makes but a single doubtful exception. In the exceptional case the epithelium is said to be columnar and probably ciliated with such fine cilia that they were not detected. Professor Owen (Comparative Anatomy and Physiology of Vertebrates, Vol. I., p. 435, 440) says that ciliated epithelium is present in the mouth of most Amphibia and in the œsophagus of the triton, and of the larvae (tad-poles) of frogs and toads.†

* As the structural indications of a division into mouth and pharynx or throat, in most Amphibia, are very obscure, if present, the alimentary canal preceding the stomach is, in this paper, considered to be divided simply into mouth and œsophagus; the beginning of the œsophagus being indicated by the narrowing lumen and the beginning of the longitudinal folds.

† The statement of Prof. Owen is very meager and neither makes a generalization nor admits of one.

As the three authors named stand very high as original investigators, as the work of one of them (Wiederscheim) was published in 1883, and as no original work upon this subject has been done, so far as I know, since their publication, their statements may be taken as representing the present state of knowledge upon the subject.

In Necturus, one of the water salamanders with permanent external gills, found in all the larger lakes and streams west of the Hudson river, the lining epithelium of the œsophagus is columnar and ciliated, but that lining the mouth is not a ciliated but a stratified, pavement or transitonal epithelium. The cells are very large and irregular, and possess a large nucleus which show quite clearly what is considered by many writers to be an intra-nucleur net-work, and also a clear zone (nuclear-membrane) separating the nucleus from the cell-body. In menopoma—the large water salamander without gills, found in the Alleghany and Ohio Rivers—the structure of the epithelium of the mouth and œsophagus is as described for necturus.

While the facts presented in this paper show the danger of generalization with reference to a specific structure or function, unless all the facts that may support or overthrow the generalization have been critically investigated; they also suggest what seems to be a fruitful field of inquiry; viz, to see what mode of life or general advancement in structure is accompanied by a ciliated epithelium both in the mouth and in the œsophagus, as in the frog; and also the conditions under which the mouth is a non-ciliated, and the œsophagus a ciliated epithelium. The mode of life and the structural conditions in necturus and menopoma point to the generalization that while in all amphibia the œsophagus is probably lined with columnar ciliated epithelium, the epithelium lining the mouth is columnar and ciliated in the forms living mostly on the land or on the surface of the water, and into whose mouth water only occasionally finds access (frogs, toads, many salamanders) while in these, like necturus and menopoma, living almost exclusively under water like a fish, the epithelium of the mouth is non-ciliated and stratified. [Read before the American Society of Microscopists at Cleveland.]

BUTTER AND FATS,

DR. THOMAS TALYOR,

MICROSCOPIST U. S. DEPARTMENT OF AGRICULTURE.

Abstract of paper read by Dr. Thomas Taylor before the American Microscopical Society, at Cleveland, Ohio

Since 1876, when my first paper was published on Butter and Fats, in the *New York Microscopical Quarterly Journal*, I have devoted a good deal of time to the investigation of this subject, principally with the view of finding a method by which I could, by the aid of the microscope, detect butter from the butter substitutes. As a result of many experiments, I find that a person experienced in the use of the microscope may distinguish the fats of various animals and of vegetables by following the methods herein described.

The experimenter should first procure a specimen of common lard. This is composed mostly of crystalline starry forms which represent the solid fats of the lard. Real lard is composed of these and the oil common to lard. In very hot weather, when the thermometer is up in the nineties, the crystals dissolve in the oil, and perfect crystals cannot then be obtained unless cooled slowly to about 70° Fahr.

Place a drop of sweet oil on a glass slide 3×1 inches, with the point of a needle. Place a small portion of the lard in the oil, and mix them together. Place a microscopic glass disc over the lard and oil mixture and press gently. If held up to the light white granules will be seen if the temperature is not over 80° Fahr.; these are fatty crystals. Under a low power of the microscope it will be observed that these crystals have stellar forms with dark centres, and spines radiating from them. See figure 7.

To procure normal crystals of beef kidney fat, render a piece of this fat in an iron pan, without water. Strain, and add sufficient sweet oil to bring the fat to the consistency of butter. Cool slowly for a period of from twelve to twenty-four hours. Mount in oil as directed in the case of lard. The crystals in this case present quite a different appearance from those seen in lard. See Fig. 8. View them by polarized light, with and without selenite plate. The beef crystals, to be seen to advantage, require a power of at least 500 diameters, being very small,

although they appear very interesting objects with a power as low as 80.

When it is desired to examine the crystals of butter, boil about an ounce of pure, newly-made butter in a test tube or iron spoon for a period of several seconds; allow it to cool as directed in the case of beef and lard; place a few grains of it on a slip of glass; pour over it a few drops of alcohol, (or better, with alcohol nine parts, carbolic acid one part;) separate the crystals with a pin, and view them with a pocket lens; they will appear like the eggs of insects, Fig. 1. Place a second portion of the same butter on a glass slide 3×1 inches; combine it with a drop of sweet oil by means of a pin, reducing the butter to granules; cover with a thick disc of glass, and view first with plain transmitted light, when crystals like Fig. 2 will be seen. Second, by polarized light. In this case place the polarizer low down and turn this prism round until its face angle crosses the face angle of the analyzing prism above. Under these conditions a dark ground is produced, and the butter crystals, which are globular in form, are seen in bold relief. The butter globular crystals will now exhibit a well-defined black cross representing that known as St. Andrew's. See Fig. 3. Figure 4 represents a crystal of butter showing divisions produced in prismatic colors when the selenite plate is used with polarized light. If old butter or a poor oily butter is used in this experiment, the secondary crystals of butter are generally shown. These crystals are of rosette form, much smaller than that of the globular, and exhibit no cross. See Fig. 6.

The globular crystals of butter, when kept for a month or more, seem to bud like a vegetable spore, and frequently every round crystal will show projecting from each a smaller crystal. See Fig. 5. The globular forms generally vary from fifteen ten-thousandths of an inch to the one-hundredth of an inch in diameter. These forms are never seen in pure beef or lard fats. Care should be observed not to press the crystals flat, especially the globular crystals, as the cross is not seen when severely pressed.

Butter crystals vary slightly from each other in size and in some other slight particulars, such as color. A butter received from Tennessee, made from milk of Holstein and native breed,

shows on its crystals indentations, a condition represented in no other butter yet observed. The butter crystals seen in the butter made at Mr. Frank Ward's dairy, from milk of Alderney cows, of Washington. also different in some particulars from all others examined, being darker in color, spines longer, and of larger size. Specimens intended for permanent use should be mounted with a varnish ring, to prevent the cover from pressing on the crystals, and to prevent the movement of the cover used to protect them.

I have examined quite a number of other fats, vegetable and animal, and find, thus far, that animals and vegetables of distinctly different genera, and even species, yield fats which give typical fatty crystals characteristic of the animals and plants which yield them, and I am confident that this new discovery will prove highly useful to microscopists and chemists when investigating adulterated substances used as food or in medical preparations.

Fig. 1.—Represents crystals of boiled butter as seen by a pocket lens.

Fig. 2.—A single crystal of butter, highly magnified, viewed by transmitted light only.

Fig. 3.—A crystal of butter viewed by polarized light only. It exhibits the cross of St. Andrew.

Fig. 4.—A crystal of butter as seen under polarized light and selenite plate. In this case beautiful colors are displayed, while the cross is but faintly seen.

Fig. 5.—Represents what seems to be a budding butter crystal. See description.

Fig. 6.—Represents the rosette crystals of butter.

Fig. 7.—The crystalline form of lard.

Fig. 8.—The crystalline form of beef.

DOUBLE STAINING.—A good example is seen in double staining the frond of a fern with logwood and aniline blue; the *sori* taking the latter, and standing out brilliantly on the general

surface tinged by the former. If a section of stem be stained throughout by a solution of eosin (2 grains to the ounce), and be then placed, after washing in strong alcohol, in a ½ grain solution of Nicholson's blue made neutral, the blue will, in a short time, entirely drive out the red; but by carefully watching the process, it will be seen that the different tissues will change colour at different times, softer cells giving up their red and taking in the blue more quickly than the harder; so that, by stopping at the right point (which must be determined by taking out a section and dipping it in alcohol, and examining it under the microscope), the two kinds of cells are beautifully differentiated by their coloring. The best effects are usually produced by carmine and indigo-carmine, logwood and picro-carmine, carmine or logwood and aniline blue or green.

To Clean Glass Slides and Covers.—First wash well in a solution of soda or potash; if this does not suffice, use the following:—Bichromate of potash, 2 ounces; sulphuric acid, 3 fluid ounces; water, 25 ounces; and afterwards thoroughly rinse in warm and cold water.

Potato.—From the large amount of water which it contains thin sections cannot be cut from the potato in its natural state. It must, therefore, be partially desiccated, either by immersion in methylated spirit for a few days, or by exposure to the air. Sections may be readily obtained by imbedding and cutting in paraffin. Such sections, mounted in balsam, are very beautiful, the starch being seen *in situ*, whilst if polarized light be employed, each granule gives its characteristic black cross.

Rush is to be prepared and cut as orange peel. Transverse sections of this plant furnish slides of exquisite beauty.

Vegetable Ivory, after prolonged soaking in cold water, may readily be cut in the microtome. The sections should be mounted unstained in balsam, and though not usually regarded as polariscopic objects, nevertheless, when examined with the selenite, yield very fine colors.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

FOR EXCHANGE—Mammoth Atlas of Human Anatomy, 45 parts, unbound, by Drs. Vesterreigher and Erdl. Cost me $33.75. Will exchange for $20 worth of accessories or objectives.
DR. C. H. LOVEWELL, Englewood, Ill.

FOR SALE—Microscopic stains of all kinds, 10 cts. per oz. Also, injecting and hardening fluids, and Leibeis Carmine gelative $1.00 per oz. Address,
RUSSELL ELLIOT, P. O. box 1216, Bradford, Pa.

FRESH WATER ALGÆ, very numerous species, inclnding Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

FOR EXCHANGE—Eleven varieties of unmounted starches (including Calabar Beans, Ginger, Calchicum, Tous les Mois, etc.,) for one mounted slide objects pertaining to vegetable histology preferred. C. F. BOOTH, 278 Greenwich St. N. Y. City.

FOR SALE—or exchange Pollen or slides of the same—Double stained vegetable sections or slides of the same. J. B. BECK, Liberty, Tioga Co., Pa.

SEEDS of Orttlocarpus Purpurasceus and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well cleaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED—Microscope stand and microscopical books and journals. Will give various articles or cash for same, Send for list. C. VON EIFF, Jr. 347 Greenwich St., New York City.

FOR EXCHANGE—A good refracting telescope 2¼ in. operture which will resolve Epsilon Lyra with half inch eye piece—value $65, will exchange for a first-class Bausch & Lomb objective.
J. E, WHITNEY, Rochester, N. Y.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg. Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

WILL exchange mounted slides of various minerals (native crystals), and others, for well mounted slides. WILL H. OLMSTED, Syracuse, N. Y.

EXCHANGE.—Parties having diatomaceous earths or other microscopical material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow. Msss.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

HISTOLOGICAL SLIDES, very thin and evenly cut, well mounted and well ringed, will be exchanged for Pathological or Histological slides only.
H. L. WHITNEY, M.D., German Hospital, Philadelphia, Pa.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

FOR SALE.—Slides, double stained, of Bacillus Tuberculosis, 50c. each.
DR. W. R. CHITTICK, 83 Lafayette Avenue, Detroit, Mich.

WANTED.—Books treating on microscopical and histological subjects not already in my possession. Will pay cash, or give slides in exchange. State name of the work, date of issue, and price. C. H. STOWELL, Ann Arbor, Mich.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

PATHOLOGICAL, Histological, and other well mounted slides will be exchanged for mounted specimens of interest. Lists furnished on application.
D. E. HAAG, M.D,, Liberty Center, Henry County, Ohio.

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ORIGINAL COMMUNICATIONS.

HOW TO MAKE PHOTO-MICROGRAPHS.

BY W. H. WALMSLEY.

DOUBTLESS most readers of "The Microscope" have had occasion more than once to make drawings from objects under observation; and how many of them ever succeeded in producing thoroughly satisfactory work? The use of the Camera Lucida is by no means an easy task to master, whilst the production of a really perfect drawing by its means requires a high order of artistic talent and acquirement, to say nothing of the time consumed. Drawing under the camera is to be commended as an instructor to the hand and eye, but the most elaborate drawing is merely an expression of what the artist *thinks* he sees, and cannot for a moment rival a photograph which can be readily and simply made in a few minutes, and from which any required number of duplicates may be printed, or transparencies made for projections on the screen, by a lantern. The purpose for the present and future papers is to present to others such plain and practical hints for successfully accomplishing this work, as my experience and practice for a number of years has made familiar to myself. If they should prove to be desirable to even one seeker after knowledge in this direction, I shall feel amply repaid for the time and trouble required for jotting them down.

Any microscope possessing a joint whereby it can be inclined to a horizontal position, may be employed for the purpose,

though certain forms undoubtedly possess advantages over others. A Monocular Body is better than a Binocular for many reasons, though the latter will enable the operator to produce quite as good work as the former, if carefully manipulated. A short body is superior to a long one, so that those possessing the modern six inch telescopic tubes, are better provided than if they had the larger and more expensive ten inch ones. A centering sub stage is a great convenience; and a stage, rotating in the optical axis of the instrument, almost indispensable. If the latter be supplemented by one with horizontal and vertical movements, which are true ann smooth in operation, the stand may be considered perfect for the work in hand. Perhaps the most perfect instrument now attainable, without being specially constructed for photographing, is the "Ideal" stand of the Messrs Beck; which, with its short body of large diameter, revolving stage, and sliding substage; with a large milled head for fine adjustment, leaves nothing to be desired by the most exacting worker. The Economic Stands, by the same eminent makers, are almost equally desirable, as are Zentmayer's Histological and some of Bausch & Lomb's smaller instruments. Indeed the very cheapest or lowest priced stand now in the market—the new "Star" by Beck's—is most admirably adapted to the uses of the Photographer, and capable of producing the very highest grade of work.

Although some work with the eye-piece on the instrument, the contrary is so generally the method adopted, and altogether so by myself, that I shall treat of it alone. Increase of power in this case with a given objective is gained by lengthening the bellows; an extension of several feet being entirely practical for lamp-light work, without serious loss of light, and none at all of definition. The Eye-piece and Draw-tube being removed, it is necessary to line the compound body with some dead black material to prevent reflections, which would cause a "*ghost*" in the negative. A simple and easy method of doing this is to make a cylinder of black flock paper to fit the tube. This may be procured of almost any paper hanger. The interior of camera and bellows must of course be of dead black to prevent any reflection, and these are always thus constructed. In the periphery of the fine adjustment screw, a groove must be turned to admit a

fine cord for adjusting the focus, when the bellows are extended, in the manner hereafter to be described.

The most important portions of the microscope, however, remain to be noticed, namely the objectives. To obtain the very highest results, these must be of the best quality, and in all powers lower than $\frac{1}{4}$ inch, should be supplied with special corrections to render the visual and actinic focii coincident. At the same time it may be stated as an axiom that any objective that will give a clear, well defined image of an object under the eye-piece, will also produce a sharp and accurate reproduction of the same upon the sensitive plate. I have made most excellent negatives with a French Triplet $\frac{1}{4}$, costing no more than five dollars, and magnifying 200 diameters, not equal it is true to the results obtainable with lenses of higher grade and finer corrections, but so good, that only a critical eye would discern the difference between them. So let not those possessing only cheap instruments be deterred from entering upon this fascinating branch of photography on that account, as their cheap tools will turn out good work, with the aid of patience and careful manipulation. Wide angular aperture is not so conducive to good results as a moderate one. Given good corrections of spherical and chromatic aberrations, good penetrating and defining powers, and the objective of moderate aperture, will defeat its wide angled rival on the photographer's field in every encounter.

It may safely be asserted that all powers in ordinary use may be successfully employed in photographing by the aid of ordinary lamp light. I have used them all from 4 inch to 1-18th homogeneous immersion; with, and without amplifiers; and all with equally good results. If a selection has to be made by one just purchasing an outfit, I would suggest a 1 inch or $\frac{2}{3}$; $\frac{1}{2}$ inch or 4-10th, and 1-5th or 1-6th. With these and a camera of sufficient bellows capacity, a range of powers from about 25 to 250 diameters may be obtained; quite sufficient for nine-tenths of the work ever required in this direction. If a higher power be necessary, then a 1-10th immersion is recommended. None of these powers from the 1-5th upwards will require any special correction. If they define any given object under the eyepiece, clearly and distinctly, it may be accepted as certain that they

will produce a correspondingly good photograph of it. But for powers less than $\frac{1}{4}$ inch, I would earnestly recommend those specially corrected for photography; else sharply defined results cannot be depended upon with any certainty. I have seen objectives of low powers, in which there was no apparent difference between the Actinic and Visual focii, and which gave—without any further corrections—negatives as sharp as the image seen upon the focusing screen; but such instances are rare, and cannot be counted upon. I would therefore reiterate—for all powers lower than $\frac{1}{4}$ inch, employ *only* those specially corrected for photography.

The great majority of negatives are made with central illumination, and for this purpose it is necessary to remove or turn aside the mirror, and condense the light from the lamp upon the object by means of an ordinary Bull's Eye Condensing Lens, with the convex side turned toward the object. No further condensation or modification of the light is necessary for any below a $\frac{1}{4}$th. For this and higher powers however, an achromatic condenser of some form is absolutely necessary. An ordinary object glass mounted in a suitable adapter, to fit the sub stage will answer in many cases, a most excellent purpose; a Kellner or Orthoscopic Eyepiece, with a cap containing a small perforation is still better, whilst a wide angle immersion or an Abbe Condenser, is best of all. In all cases, working with or without a condenser, a diaphragm for controlling the volume and intensity of the light *must* be employed to obtain uniformly excellent results. Different subjects require widely different treatment in the way of illumination, with the same objective. A full blaze of light with an open aperture would be necessary in photographing the yellow chitinous portions of an insect; whilst the delicate, colorless tracheal system of the same, would necessitate the employment of a small top and subdued light. In all cases, and especially with delicate transparent tissues or other substances, all excess of illumination must be carefully avoided, or the result will be a flat, spiritless negative, void of contrast, and yielding prints of like indifferent qualities. Experience alone, will enable one to successfully determine the proper amount of illumination, but if this be made a careful subject of study from the beginning, it can readily and

speedily be mastered. Upon the proper lighting of the subject, depends in a great measure the quality of the resultant negative.

Objects requiring to be obliquely illuminated, or by means of Paraboloid, or Polariscope, may be quite as successfully photographed by lamp light, as those which are centrally lighted; whilst all opaque bodies capable of reflecting light are equally impressionable upon the sensitized plate. In short, we have in the Gelatine Dry Plate an agent, wherewith may be accurately produced the image of *any* object seen in the field of the Microscope, and from which Lanterns slides for projection upon the screen may be made by anyone, far more accurate and truthful than the most elaborate drawings of the skilled artist.

TO BE CONTINUED.

PROF. ROGERS' RULING MACHINE AND METHOD OF RULING STANDARD MICROMETERS.

BY PROF. MARSHALL D. EWELL, M. D., LL. D.,

UNION COLLEGE OF LAW, CHICAGO, ILL.

BY the courtesy of Prof. W. A. Rogers, of Harvard Observatory, I had an opportunity of spending several days with him in the month of August, just ended, studying his methods of ruling and comparing standard micrometers; and as the subject is one of great interest as well as importance, and as Prof. Rogers is acknowledged on all hands to be the highest authority in this country upon the subject of micrometry and standards of length, I have thought the matter of sufficient interest to warrant its publication, and have accordingly, with Prof. Rogers' permission, written this brief account of the same. It will be impossible for me by mere words, without drawings, to give an adequate detailed description of this wonderful machine, and I shall attempt only a general description of its essential features.

The machine consists essentially of a precision screw, 18 inches long, having a pitch of 1-20th of an inch, with an index wheel about 10 inches in diameter attached to one end, the circumference of which is divided on the edge into 100 equal parts. This screw, by means of a half nut resting upon it, carries a table upon which is placed the plate to be ruled. As you stand

in front of the machine this table is nearest you and the index wheel is at your right hand. The screw is provided also with a wheel and crank at the right of the index wheel by means of which the screw may be revolved independently of the automatic movement to be presently described. Each revolution of the wheel is registered by an index on the right end of the machine, in appearance like the face of a watch.

At the rear side of the machine and parallel to the screw is a shaft attached by means of a pulley to a small water-motor. Upon this shaft, which extends the greater part of the length of the machine, is an eccentric which, with every revolution, moves a rod carrying the diamond-holder at right angles to the axis of the screw. By an ingenious mechanism, which is difficult to describe in words, but very simple when you see it, every 5th and 10th line may be made longer than the others, and every 10th line longer than the 5th. The diamond-holder is provided with a screw with an index-head by means of which the diamond may be set at any desired inclination, and there is a device for lifting the diamond above the surface of the plate after a line has been ruled, while it is moved forward preparatory to another stroke. The shaft above described also has near its end, two circuit-closers by means of which the circuits through the electro-magnets, to be presently described, are closed and broken, and also a cam which actuates the lever to be presently described.

Extending along the right side of the machine between the cam above described and the index wheel, is what Prof. Rogers calls his "Universal Ratchet," which he considers the key to the problem of automatic ruling. The universal ratchet is only used when spaces of 1-1000 inch or less are to be ruled, as, from the following description, it will be obvious that by it the index of the screw can be moved only a fractional part of a revolution. When longer spaces are required the screw is turned by the wheel and crank above described.

This universal ratchet consists of a lever about two feet long, upon the end of the short arm of which and in contact with the edge of the index of the screw are two electro-magnets made concave so as to fit accurately against the edge of the index wheel. The long arm of the lever, which is moved by the cam

at the end of the shaft above described, moves between two stops in a solid, upright plane, the distance between these stops, and hence the movement of the lever, can be regulated with great precision, by means of a screw with a finely graduated head. By this means, the extent of motion of the precision screw can be regulated with the greatest exactness. The number of movements of this lever, and hence of the lines ruled, is registered by an index having on a face like a watch and situated over the long arm of the lever.

Underneath the index wheel of the precision screw and in accurate contact with the edge of it, are two other electro-magnets, which, when their circuit is closed, hold the index firmly in its then position. Over the index-wheel of the precision screw is a microscope, with an eye-piece micrometer of 100 equal spaces, so adjusted that the end lines exactly coincide with the lines bounding one of the 100 equal spaces into which the index wheel is divided. The pitch of the screw being 1-20 inch, and the index wheel being divided into 100 equal parts, one of the divisions of the eye-piece micrometer obviously represents a movement of the table bearing the plate to be ruled of 1-200,000 of an inch.

Dismissing for the present the important question of corrections for errors of the screw, suppose that a plate is in position upon the table, that the several indexes are at zero, and that it is desired to rule any number of lines 1-100 mm. apart. The value of each division of the index, regulating the distance between the stops which limit the movement of the long arm of the lever, having been previously ascertained by comparison and computation, this index is set at the proper figure and the machine is started. At the proper part of the revolution of the shaft, the circuit connected with the electro-magnets at the end of the short arm of the lever, is closed (the circuit connected with the electro-magnets under the index-wheel being broken) and the short arm of the lever is firmly fastened to the edge of the index wheel, the cam, revolving at the end of the shaft moves the lever, and through it the index wheel of the screw, through a distance representing a motion of the screw of 1-100 mm. At this point the first circuit is broken and the second connected with the electro-magnets and the index wheel is closed, and the wheel

is firmly held in its then position. The shaft, which has meanwhile continued to revolve, by means of the eccentric above described, now drops the diamond into contact with the plate, and moves the diamond-holder, ruling a long line on the plate, immediately at the close of which process the diamond is automatically lifted a short distance above the plate and by the continued motion of the eccentric carried back to its original position ready for another stroke. The index meantime has recorded one line. At this point of time the second circuit is broken, the first circuit is closed, the long arm of the lever, which has now by means of the cam, regained its original position, is again moved between the stops, and the plate is again advanced 1-100 mm., and another, and this time a short line is ruled, and this process is repeated again and again as many times as desired, every 5th and 10th line being made longer than the others, as above described.

So much for the merely mechanical part of the process.

This, however, alone will not insure the making of a correct micrometer. Before ruling a micrometer the errors of the precision screw must have been investigated and the necessary corrections determined. These errors are of two sorts: periodic errors of a single revolution, and lineal errors, each of which must be investigated. Briefly, the periodic errors are investigated by ruling lines every 5th or 10th division of the index-wheel for one complete revolution, and comparing these spaces with each other upon a separate comparator, or by using the same part of the precision screw of the ruling machine as a comparator, in which latter case, the corrections can be determined in terms of the divisions of the eye-piece micrometer of the microscope on the index wheel. The lineal errors are of course investigated by comparison of ruled spaces with a standard upon a comparator in the usual way.

Assuming these errors to have been investigated, their corrections ascertained, and a table of corrections prepared, if it is proposed to rule a standard micrometer, the first thing to be done is to prepare a table of settings of the index so as to apply these corrections. The next step is to find a ruling crystal upon the diamond. This is a process requiring great practice and experience. The empirical method of cut and try, is the method

adopted. A few lines are ruled, examined under the microscope, and if their character is unsatisfactory, the inclination of the diamond to the plate is changed, more lines are ruled, and examined, till a suitable crystal is obtained. Prof. Rogers informs me that he has never yet been able to see a ruling crystal under the microscope, and only knows their existence from their effects. The time consumed in finding a ruling crystal is often considerable. I should say that at least 3 hours were spent in search before one was found that was satisfactory for the work done by Prof. R. in my presence upon the occasion referred to at the beginning of this article; and I suppose that it would have taken one of less experience much longer.

A satisfactory ruling crystal having been found, if the bar to be ruled is of such a length, say one decimeter, that a correction for temperature is necessary, a trial set of lines is ruled at any convenient distance, say one centimeter, apart. The plate is then put upon the bed of a comparator, and allowed to remain there long enough to acquire the temperature of the comparator, and a comparison made with a standard bar of the same material as the bar to be ruled. The difference in length, if any, having been ascertained, the correction necessary to make the plate standard at 62° F. is applied, and the ruling done in the manner above described, the finer rulings being made automatically, using a part of the precision screw for which the corrections are the most nearly uniform, and the larger spaces being ruled without the use of the automatic part of the machine.

During the time the automatic ruling is being done, the operator occasionally looks through the microscope at the revolving index to see that no farther correction is necessary. If at any time the accumulated error appears from the index to equal two divisions of the eye-piece micrometer, (1-100,000 inch) correction is at once applied; but the machine is so accurate, that when the setting of the index, regulating the distance between the stops, is once correctly made, such further correction is not often necessary.

When a set of graduations has been ruled, if it is desirable to rule another set on the same plate, the precision screw is turned back to zero of position, the length of the rod moving the diamond and holder changed, and the new set ruled; and so

accurate is the machine, that the first lines of the two sets, when care is taken in making the adjustments, will be absolutely concident, forming one and the same straight line. I have not, in sets that I have examined, been able to detect the slightest deviation, under any objective that would include the junction of the two lines in its field.

The comparison and investigation of any standard thus ruled is next in order, but lack of space will prevent any further consideration of the subject in this paper.

AN IMPERFECTION OF THE EYE AND TEST OBJECTS FOR THE MICROSCOPE.

BY LUCIEN HOWE, MEMB. ROYAL COLL. SURG., ENG.

MY object in this short communication is to call attention to the fact that fine parallel lines, whether drawn artificially or existing in natural objects, do not make fair test objects for the microscope. This is caused by an imperfection very common in our own eyes. In order to make that clear I would call the attention of the society to the formation of the image of any object on the retina of the eye. It is well known that this optical instrument is constructed like the camera obscura. At the anterior part there is a lens and at its focus a part upon which the image is received. Theoretically, the lens should have a perfect spherical surface, and therefore the image should be equally well defined in all its parts. With the camera obscura this is often the case. In the human eye, however, the lens has its power augmented by a refracting surface, called the cornea, which lies in front of it. When the type of perfection is reached this cornea and lens have perfect spherical surfaces, and therefore the focus which they form upon the retina is equally distinct in every direction, vertically, obliquely, or horizontally. Practically, however, this type of perfection is seldom or never attained. The imperfect curvature is usually found in the cornea. Instead of being a section of a sphere it is more curved in the vertical than in the horizontal meridian, and might be compared, in a rough way, to the convex surface of a spoon, when that is held horizontally. This variation from the typical form can be shown by a number of simple experiments.

If, for example, a circular pin hole be made in a card, and held at varying distances from the eye, it will appear horizontally oval at one point and vertically or obliquely oval at another. The same principle can be illustrated in still another way. If upon a sheet of paper a number of *equally* dark lines be drawn, radiating from a single point, like the spokes of a wheel, and this figure be held a distance from the eye, it will be found that certain ones of these lines appear to be darker than others, although in reality they are all the same. It is unnecessary to multiply the experiments. The existence of this peculiarity has long been well known to oculists under the name of astigmatism. The great authority in the refraction and accommodation of the eye, Professor Donders, treats astigmatism as one of the qualities of the normal eye. The practical fact is, that we all possess this imperfection in a greater or less degree. When it passes beyond a certain point it then is classed as morbid, and requires suitable glasses to correct it. Now the point to which I wish to direct your attention is, that when a person looks through the microscope at a series of fine parallel lines it occurs very frequently that they can not be seen on account of this peculiarity of his eye. At any rate when one of Noberts' test plates is subjected to examination the perpendicular lines which one person would see perfectly well would not be seen by another person who might consider his vision in every way normal. The same, of course, holds for other tests of a similar nature, such as diatoms or objects marked with fine dots or lines in close juxtaposition. This is by no means an imaginary difficulty, as it has occurred to me more than once to find this difference of opinion between persons who are accustomed to view such objects, and whose eyes and hands are trained to use the microscope. Fortunately, however, there is a very simple method of overcoming the difficulty. This consists in revolving the object on the stage of the microscope, in such a way that lines which at first were vertical become afterwards horizontal, for when turned through an arc of one hundred and eighty degrees they pass through every meridian in which it would be possible to see them, provided the amplification and definition be sufficient to make them at all visible. This question or the relation of astigmatism to test objects for the microscope, seems to

have been overlooked by most, if not all, writers on the subject. Upon examination, however, it would appear to be of considerable importance, and as such I venture to direct to it the attention of the society.

THE ZEISS 1-18 OBJECTIVE.

PROF. ALLEN Y. MOORE.

HAVING recently had an opportunity of making a careful comparison of a Zeiss 1-18 and Spencer 1-10, I should like to detail the results for the benefit of intending purchasers who have become dominated by the idea that foreign objectives are far superior to those of our own makers.

The Zeiss objective is one of those constructed upon the principle of homogeneous immersion, yet not adjustable. The aperture claimed for it is 114°, but in Chance's hard crown glass it only yields 110°. The working distance is extremely short, being only about 0.0055 inches—thus preventing its use upon many of my most valued tests. The magnifying power is 200 diameters measured at 10 inches from the front lens; thus showing it to be really more than the nominal focus would indicate. The mounting is rather peculiar, being only about 1.6 inches in length while its greatest diameter is 1.1 inches. This shortness and its general make-up make it resemble very closely the adapters so frequently seen with the cheap French triplets, although it shows superb workmanship.

Such a test as an ordinary balsam mounted *Amphipleura pellucida* is easy for either objective, and as the corrections were somewhat similar, I knew I should have to select a very difficult test to bring out any great difference in the performance of them. For this purpose I selected a valve of *Amphipleura pellucida* of more than ordinary fineness, balsam mounted, and used the light direct from the mirror—having no hemispherical lens or other illuminator between the mirror and the object. Under these circumstances the Spencer lens gave a good resolution of the lines while the Zeiss would not show them at all. Lest it be urged that the 1-10 had the advantage in being adjustable, I will state that the 1-18 was carefully corrected for thickness of cover, etc., by the draw tube, and the 1-10 was sub-

sequently corrected by collar for the same length of tube—thus securing "equal rights" with each.

The condition of field was next taken into consideration. For this purpose a fine valve of *Frustulia Saxonic* was selected, and so placed in the field (which was rendered of the same size with each objective by the use of the proper eyepieces) that one end was in the center while the other end was at the extreme edge of the field. When thus arranged, the Zeiss showed the lines distinctly as far as the central nodule while the Spencer showed the lines all over the valve.

Any attempt at a proper test by central light was rendered extremely difficult from the short working distance of the 1-18. I should liked to have used the mercury globule but gave it up —relying entirely upon the two tests given as deciding the merits of the lenses.

I am sorry that I had neither Bausch & Lomb's nor Gundlach's objectives of similar power to try against the Zeiss, for I am fully satisfied (from the reputation the Zeiss lenses have in Europe) that the best objectives made anywhere are in the United States.

THAD S. UP DE GRAFF, M. D., F. R. M. S.

C. H. STOWELL.

IT was never my good fortune to meet him whose death brings sadness to so many hearts. But from correspondence only one could readily understand why it was that Dr. Up de Graff had so many warm friends. His generous nature was constantly showing itself and "he had the rare faculty of making his opponents at last his true friends." A life-long friend of his promised our readers a sketch of his life, but was unable to carry out his desires. So at the last moment, just as we go to press, how can I, a stranger, speak in proper words when one of his nearest friends has said that—"of his generosity, of his devotion to his friends, of his sacrifices for others, of his grand hospitality, of his delight in making others happy, of his versatility in entertaining, of the thousand splendid traits of character he possessed and which need not be rehearsed to those who knew him; of these I could not narrate the half had I unlimited room and time. These are memories for us, his closest friends, to cherish forever, and enjoy unto our dying day."

EDITORIAL NOTES.

BLOOD UNDER THE MICROSCOPE.—The article we copy from the "Scientific American," under the above title, is a fair specimen of scientific truth adapted to the popular demand. We do not here criticise Dr. Piper in any way, for there is no positive evidence that he said what is here credited to him. But there are thousands of people who have read the article, now ready to believe that the microscope can tell the blood of a man from that of a woman; or purchance the blood of a "furious" man from that of a "mild" man; or perchance by an examination of the blood we can tell the disposition or temperament of an individual; hence the extreme value to young men about to engage in matrimony, for how easy and valuable to have the question of temperament decided before it is everlastingly too late. Plenty of rich fees already loom up before us, and by the aid of Heitzmann's wonderful skill in this kind of work, we see engagements made and broken, marriages forbidden and recommended all at our bidding. Perhaps, however, when a man is on a pillow his blood corpuscles are softer and rounder than when on a hard, flat carpet. But it is to the last paragraph of the article that we call serious attention. In a word, we believe the facts have been reversed. It should say that as between human blood and dog's blood it is impossible to tell, while between human blood and hog's blood it is certainly possible to tell. Prof. Wormley says his measurements give for man, 1-3,250; for the dog, 1-3,561; for the hog, 1-4,268.

MR. GEO. S. DAVIS, of Detroit, has just completed arrangements to offer a case of Materia Medica Specimens, containing 288 specimens of the crude vegetable drugs. Students of medicine and pharmacy will gladly avail themselves of this opportunity. The whole collection is listed at only ten dollars.

WHITE ZINC CEMENT.—As a result of considerable corre spondence with Dr. F. L. James, of St. Louis, we have discovered some of the causes this cement, as made by some houses, is not always satisfactory. For instance, when we said that the materials used to make this cement were all cheap and that as a result the cement should sell much cheaper than it does, he replied as

follows: "It is true you can get benzol at the figures you name, but I pay just double the price you mention. I use only Merck's chemically pure, crystalized benzol. As to the damar, that too is cheap in the crude condition, and when used in that way is another cause for poor cement. I take only picked lumps and dissolve them in pure benzol slightly in excess of what is necessary. After filtering through absorbent cotton I add a little zinc oxide and agitate for a few moments, then set aside to clear, which it does in three or four days. I never make up more than two drams of the cement at a time, rubbing this thoroughly and pouring into a stock bottle and then repeating the operation. In making up a pint of this cement the mortar is emptied from 60 to 70 times." All these items and others the doctor mentions contribute to the excellence of his article. By following his method, and by selling the cement at 40 or 50 cents an ounce we are in great fears that the net pecuniary emoluments derived therefrom will quite overwhelm him.

BAUSCH & LOMB state that they have now overcome all difficulties in the working of their microtomes and they invite interested parties to examine them.

WE would call attention to the change in the advertisement of Mr. Zentmayer. His new illustration shows the "Histological" microscope improved. The body is enlarged to take the eye pieces of the Army Hospital pattern; the substage is likewise enlarged. The mirror bar is made sliding, and the base is larger. Mr. Zentmayer is ever awake to the interests of his patrons.

IS IT A FRAUD?—The editor of the "Cincinnati Medical News" had an editorial in a recent number entitled "A Fraud." He relates how a house doing business in Cincinnati promises to sell a microscope "which is represented to have belonging to it a half inch and one-sixth inch objectives, the latter able to resolve p. angulatum, for $22.50." The editor pronounces it a fraud and a swindle. We fear he is a trifle hasty in his judgment, for certainly the firm mentioned is not far from telling the truth. We are ready to make the announcement that we can tell any one where to buy a microscope with neatly japanned base and pillars; with an arm that can be inclined to any angle; with

perfect rack and pinion adjustment; with tube of standard length, supplied with society screw; with brass stage, and revolving diaphragm; with mirror; with any Huyghenian eyepiece; with walnut case; and with a 1-2 inch objective and a 1-6 inch that can easily resolve p. angulatum, all for $22.50. We would not advise our readers to buy such an outfit, neither would we think of calling this business house a fraud and a swindle.

MR. GRIFFITH'S LATEST.—We have before us a letter from San Francisco, written to Mr. E. H. Griffith. It speaks in the warmest terms of Mr. Griffith's plan of collecting the photographs of members of the American Society. Just on this point we copy from "The National Druggist:" "Dr. James, of St. Louis, remarked that while the society was in a thankful mood there was another matter to which he desired to call attention, and another man to whom he thought the society owed a vote of thanks. He called the attention of the society to the collection of cabinet photographs of the members which was displayed upon the walls, and which had been gathered together by Mr. E. H. Griffith, with a view of "securing the shadow ere the substance fades" of each and every one who had joined our rolls. He would, therefore, move a vote of thanks to Mr. Griffith for his action in the matter.

"Professor Stowell said jocosely that Mr. Griffith had not yet formally presented the pictures to the society. Everybody knew how grasping and over reaching Griffith was in a trade, and the first thing we knew he might be coming around here with a bill against the society, charging us $1 a head for the photos.

"The allusion to Mr. Griffith's 'grasping and overreaching ways in trade' was received with a broad and audible smile by the society, most of the older members of which had time and again swindled him in one way or another—in fact every time that they could get him to trade—and he was as fond of it as though he always got the best of the bargain.

"In answer to Mr. Stowell's remark, and amid calls for Griffith! Griffith! that gentleman arose, his face beaming with pleasure, and his top hair actually curling under the blush that extended from his chin to the back of his neck, and formally presented the collection to the society, accompanying the gift

with a most feeling allusion to those members who had crossed to the other shore, and whose faces we would see no more among us forever."

FOR NEW SUBSCRIBERS.—If you will send us one dollar and will inform us that you read this notice, we will send our journal to your address until January first, 1887, or one year and three months from date.

ADVICE FOR ONE DOLLAR.—If you want old matter copied from some old journal do not subscribe for THE MICROSCOPE; but if you want to read a journal that contains more original matter than any monthly microscopical journal ever published in this country then send us one dollar, and we will tell you what journal to get.

THE S. S. AND S. MAN.—Prof. Smith, in his inaugural address, told us that there are men who look upon the scientific man as one who must "Snap, Snarl and Sneer." If any of our readers know of any of these men who would like to look upon their ideal scientific man we know of one of the regular three S. kind. He resides in this country, and Mr. Cole, of London, could tell you his business and residence.

MR. WALMSLEY, of Philadelphia, now offers to make photo-micrographs from any specimens you may choose to send him. There is scarcely a microscopist who does not have a few mounts he would like to have photographed in this way. A few prints can be made and sent to friends and thus a specimen of your work shown, or some point in the structure of the tissue illustrated. Mr. Walmsley will make known his terms, "which will be very reasonable," upon application. As no better worker can be found in this country we believe many will avail themselves of this opportunity. Mr. Walmsley has also just brought out an entirely new micro-camera, which can be used for copying, enlarging or reducing, and for transparencies as well.

DR. CHASE says that he has but a very few copies of "Habirshaw's Catalogue of the Diatomaceæ" left, and those wishing copies must apply at once.

THE Medical Department of this University opens with over three hundred students, with one hundred registered for Histological work for the first semester. This means plenty of hard work and much of real pleasure.

WE have received some samples of cells for opaque mounts which are neat and tasty in appearance. They are attached by gently heating the slide, and they are offered for only twenty-five cents a dozen. Address Geo. E. Ashby, 103 Maiden Lane, New York.

SOMETHING must be done to stop the ingenious working of our friend Allen Y. Moore. None of our lives will be safe if he continues. A one-fiftieth eye-piece; a microscopic Geissler tube; resolution of amphipleura with a half-inch; silver-plated diatoms; and now, at last, there is before us a slide of *gold-plated* diatoms. One thing, however, he will never be able to do—to show the wonderful network of Carl Heitzmann.

SELECTIONS.

BLOOD UNDER THE MICROSCOPE.

According to the *American Bazaar* the only instance on record when the blood of two persons was compared in a criminal trial was in a murder case at Chicago. The comparison settled the innocence of the woman on trial for her life. A comely woman, with $20,000, married a man in Chicago, and placed her snug little fortune in his business. In the course of time he commenced to abuse her, and finally she decided to apply for a divorce. The double calamity of losing a woman to beat and the withdrawal of her $20,000 from his business made the brute furious, and the next morning he was found dead in one corner of his bedchamber, a bullet having gone through his heart. His wife was found wounded in another part of the room. She said that her husband had come home the night before in a rage and began to abuse her while she was in bed, that he hit her on the head with the butt of his revolver while her head was on the pillow, and spattered blood over the linen; that she jumped up, and he shot her, inflicting a slight flesh wound in her side.

She then rushed at him, and, snatching the revolver from him, shot him through the heart. He reeled to the corner where he was found, and died. The prosecution did not believe her story, and set up the theory that she shot him when he was asleep, and dragged him to the corner, and then inflicted the

wound upon herself. The carpet where the dead man lay was saturated with blood. According to the theory of the prosecution, the blood on the pillow was his also. Dr. Piper put the section of the pillow with blood upon it under the microscope, and drew on a cardboard the shape of the corpuscles, enlarged about two thousand diameters. He then put the blood on the carpet under the microscope in the same way. The comparison settled the question at once.

The blood corpuscles were as different as day and night, and sustained the woman's account of the shooting. She was acquitted on that and other evidence.

As between human blood and dog's blood, the microscope enables the expert to determine precisely whether a specimen is from a human being or a dog. But it is impossible to determine between human blood and a hog's blood.—*Scientific American.*

PERMANENT MOUNTING OF TRACHEAE OF INSECTS.

F. T. HAZLEWOOD.

I have succeeded in a very simple way in mounting permanently the tracheal system of insects. I dissect out the soft parts and spread them on a glass slide of the usual size; let them dry perfectly; then with pencil-brush give them a good coating of collodion, after which I melt a little hard, pure balsam in a test tube and put it on the object with a cover glass applied at once. This is, so far as I know, a new method. It is remarkable for its results. The intestines, the ganglia, and the brain are perfectly magnificent. The intestine makes thus one of the most beautiful objects for dark-ground illumination. The brain shows the most abundant ramifications of the trachea, especially in the immense parallel branches in the rods of the eyes. The ganglia can be floated on a cover glass, dried, and mounted in this way. The entire process is simple and easy, and gives the most satisfactory results. There are many points of histological interest in the brain which are thus demonstrated.

THE JOURNALS FOR SEPTEMBER.

The MICROSCOPE contains in a series of detached articles a pretty full report of the Cleveland meeting of the American

Society. The personal notes of the meeting are in Brother Stowell's best vein, and are a reflex of the good feeling which prevailed at Cleveland, and of which I have already spoken. The amount of space taken up by these reports prevents the MICROSCOPE from giving its usual quantity of general microscopical news. Among the original papers will be found one from Mr. Ouderdonk, of Rugby, Tenn., on the motion of diatoms, that will prove interesting to our readers. Professor Stowell promises an enlargement of the MICROSCOPE at an early day. So mote it be. It is hard to get too much of a good thing.

MY SIMPLE FARE.

BY ROBERT J. BURDETTE.

Placid am I, content, serene,
  I take my slab of gypsum bread,
And chunks of oleomargarine
  Upon its tasteless sides I spread.

The egg I eat was never laid
  By any cackling feathered hen,
But from the Lord knows what 'tis made,
  In Newark by unfeathered men.

I wash my simple breakfast down
  With fragrant chickory so cheap ;
Or for the best black tea in town
  Dried willow leaves I calmly steep.

But if from men's vile arts I flee
  And drink my water from the pump,
I gulp down infusoriæ,
And quarts of raw bacteriæ,
And hideous rotatoriæ,
And wriggling polygastricæ,
And hard-shelled ophryocercinæ,
And double-barreled kolpopæ,
Non-loricated ambodæ,
And various animalculæ
Of middle, high and low degree,
  For nature beats just all creation
  In multiplied adulteration.

A NEW COMMA BACILLUS.

BY DR. W. D. MILLER.

Considering the great interest which for some months has centered around the so-called comma bacilli, a short description of a new member of this probably very numerous and widely distributed family may not be out of place.

In the month of May I had occasion to spend a day in Egerstorff, near Hanover, and in the gutter water, as also in the drinking water of this untidy village, I could easily detect, by the use of the microscope, the presence of a comma bacillus. Its pure culture was accomplished on agar-agar without much difficulty; on this medium it grows rapidly at blood or room temperature, and forms on the surface a thin, bluish, semi-liquid layer, one-half to one mm. thick. On ten per cent. peptone-gelatine it grows rapidly at first, but after forty-eight hours its growth seems to cease altogether. On plates, in the second or third dilution, after twenty-four hours' growth, the colonies appear, under one hundred diameters, very irregular, lobular, grayish in color, and traversed by fissures. It differs from all comma bacilli yet discovered, in that it liquefies neither gelatine nor blood-serum. On potato it grows poorly at all temperatures. It is somewhat smaller than the comma bacillus which I isolated from the oral secretions, and possesses in a high degree the peculiarity characteristic of the other comma bacilli, of assuming a great variety of shapes and sizes. In growing colonies on agar-agar, the cells are tolerably regular, comma or S-shaped; occasionally one finds spirilla, or long, closely twisted leptothrix. In older cultures, on the other hand, the cells become mostly round, or oval, or lemon-shaped, sometimes much increased in size, while the protoplasm is granularly differentiated. In gelatine the cells are mostly short and plump, while on potato almost any form may be found.

The statement of Klein, that comma bacilli occur in the cœcum of healthy guinea-pigs, I have been able to confirm. I did not, however, find them in such numbers as I had expected, after reading his report. Attempts at pure culture did not succeed, so that it would be hazardous in the extreme to make any suppositions as to the identity of these guinea-pig bacilli with any of the known comma bacilli.—*Independent Practitioner.*

ON MOUNTING MICROSCOPIC OBJECTS.

STAINING WOOD SECTIONS.

After the sections have been bleached and thoroughly washed by the methods just described, we may proceed to stain them. This may be done by the use of carmine or logwood; after which, the sections may be mounted in balsam by the ordinary process. Better effects are, however, produced if we employ the *double* staining method, for the carrying out of which various kinds and combinations of dyes have been used and recommended. It is needless to enumerate the whole of these here. The agents used are carmine and aniline green, and to carry out the method, solutions of these will be required. The solution of carmine (Beale's) is made by rubbing up in a mortar; carmine (the finest), 15 grains (or about 1 gramme), with a few drops of distilled water; then adding ½ drachm of strong *liquor ammoniæ* and sufficient distilled water to make 8 drachms of solution. The fluid must now be exposed to the air for two days to get rid of superfluous ammonia, when 7 drachms of distilled water are to be added to it. Many recommend the carmine solution to be made with borax instead of ammonia. It is not in our opinion nearly so good as that mentioned above, as it not unfrequently spots the stained sections with an apparently crystalline deposit, which utterly ruins them. This never occurs when ammonia carmine is employed; that is, if the solution used be fresh. To prepare the green dye, take 3 grains of aniline green, and by means of heat dissolve it in 2 drachms of distilled water; then filter this solution into 6 drachms of absolute alcohol. If wood sections, without any previous preparation, were to be stained with these agents, we should find that when, in order to mount them in balsam, the sections being passed through alcohol in the usual manner, a great part, or the whole of the color due to the action of the aniline green would be discharged by the alcohol. In order, therefore, to render the staining permanent, it is advisable to use some kind of mordant to fix the aniline stain, and for this purpose we have found tannic acid extremely useful. It is employed in the form of solution made by dissolving 1 drachm of the acid in 2 ounces of methylated spirit, and then filtering the product.

The sections to be stained, having been bleached and washed in the manner already described, must, after a short preliminary soaking in alcohol, be placed in the tannic fluid for about one minute, and thence transferred to the green dye for three minutes, upon the expiration of which time they are to be rapidly washed in distilled water, and immediately passed into the carmine fluid, there to remain for from three to four minutes, then rinsed in dilute acetic acid (5 drops of glacial acetic acid to 1 ounce of distilled water), again rapidly washed in distilled water, and finally transferred to clean methylated spirit. Let them remain in this for five minutes, pour off the alcohol, and replace by fresh spirit; allow the sections to remain in this another five minutes, and afterwards transfer to oil of cajuput. In ten minutes pour off the oil of cajuput, and replace by turpentine, in which they should be allowed to soak for five minutes, when the sections are ready for mounting in balsam. It must be noted that the times given above are only approximations, and will not hold good for all cases, since the time required for the action of the stain is materially modified by the thickness of the section, and by its physical structure, and very possibly also by its chemical constitution. It will be found in practice, that, for the general run of wood sections, very little variations from the times indicated will be required. When an alteration in this direction is necessary, it will be within very narrow limits, and to carry it out successfully will not tax either the ingenuity or the patience of the experimenter very severely. Wood sections stained by this method make beautiful preparations. Not only are certain portions of the sections dyed green and crimson respectively, but other portions acquire various intermediate tints, so that certain sections of much diversity and complexity of structure, when stained by this method, rival in splendor some of the diatoms. We will give a few examples of pretty botanical sections:—

Orange Peel, common object though it be, is not to be despised by the microscopist. Transverse sections must be prepared by the gum method. These sections are not to be subjected to the action of alcohol; but after drying between glass slips, soak them in turpentine and mount in balsam. We shall then have a good view of the large globular glands whose office it is to secrete the essential oil, upon which the odour of the orange depends. Sections may also be bleached, and stained with carmine and aniline green as before mentioned.

Sponge may readily be cut after being tightly compressed between two pieces of cork, or its interstices may previously be filled up by immersion in melted paraffin or mucilage, and sections cut in the usual manner.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

WANTED—One copy of each of the following numbers of Phin's Journal of Microscopy. Vol. I., No 1; Vol. III., Nos. 2 and 7; Vol. IV., Nos. 5 and 6. Will give a well mounted and interesting microscopic object per copy for any of the numbers wanted.
M. S. WIARD, New Britain, Conn.

5 VEGETABLE slides, double-stained, new method, formulæ and short process for preparing them, all for $3. J. D. BECK, Liberty, Pa.

FOR EXCHANGE—Zeitschrift fur wissenschaftliche Mikroskopie, Volume I., 1884. Would prefer type-slides of diatoms in exchange. Address,
A. B. AUBERT, Orono, Penobscot County, Maine

FOR EXCHANGE—Mammoth Atlas of Human Anatomy, 45 parts, unbound, by Drs. Vesterreigher and Erdl. Cost me $33.75. Will exchange for $20 worth of accessories or objectives.
DR. C. H. LOVEWELL, Englewood, Ill.

FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

FOR EXCHANGE—Eleven varieties of unmounted starches (including Calabar Beans, Ginger, Calchicum, Tous les Mois, etc.,) for one mounted slide objects pertaining to vegetable histology preferred. C. F. BOOTH, 278 Greenwich St. N. Y. City.

SEEDS of Orttlocarpus Purpurasceus and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well cleaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED—Microscope stand and microscopical books and journals. Will give various articles or cash for same, Send for list. C. VON EIFF, Jr. 347 Greenwich St., New York City.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Poplcine, Virg. Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

EXCHANGE.—Parties having diatomaceous earths or other microscopical material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow. Msss.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

HISTOLOGICAL SLIDES, very thin and evenly cut, well mounted and well ringed, will be exchanged for Pathological or Histological slides only.
H. L. WHITNEY, M.D., German Hospital, Philadelphia, Pa.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

FOR SALE.—Slides, double stained, of Bacillus Tuberculosis, 50c. each.
DR. W. R. CHITTICK, 83 Lafayette Avenue, Detroit, Mich.

WANTED.—Books treating on microscopical and histological subjects not already in my possession. Will pay cash, or give slides in exchange. State name of the work, date of issue, and price. C. H. STOWELL, Ann Arbor, Mich.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

PATHOLOGICAL, Histological, and other well mounted slides will be exchanged for mounted specimens of interest. Lists furnished on application.
D. E. HAAG, M.D,, Liberty Center, Henry County, Ohio.

THE MICROSCOPE.

VOL. V. ANN ARBOR, NOVEMBER, 1885. No. 11.

ORIGINAL COMMUNICATIONS.

CAN THE SPECIES OF EXOGENOUS TREES BE DETERMINED BY CELL-MARKINGS.

PHILIP E. LAWRENCE AND CHAS. S. RADDIN, EVANSTON, ILL.

IT is held by many botanists and microscopists, that the families, genera, and species of woods, may be determined by the markings on the cell walls; that each tree bears within itself a signet, invisible to the naked eye, which stamps its character.

There being no standard of drawings or descriptions to which microscopical investigations in this line could be referred, a collection, numbering upwards of two hundred species, was obtained from different parts of the United States, and drawings made of the supposed characteristic structure, with results that raise serious doubts as to the veracity of the theory, for not only was there an absence of any family characteristic,—with the exception, perhaps, of the coniferæ,—but still less any generic or specific, distinctive properties. Every tribe examined contains some species, characteristic of, and in many cases impossible to distinguish from, specimens from other families. For example,—the slippery elm, ulmus pulva,—the red oak, quercus rubra,—and some of the pines are almost undistinguishable, as not only do the cell-markings bear the same relation to each other and present a similar appearance, but measurement shows no appreciable difference in size.

Upon discovering that an eminent microscopist of Chicago had carried on similar observations, obtaining similar results, we now set about to break down the theory to which we had pre-

viously sought to add confirmation. To this end, woods of like species were collected from different states and parts of the states, with the belief that should the cell-markings of a certain tree differ with the locality, or according to the conditions under which it grew, it would satisfactorily prove, at least to our own minds, that no such determination is possible. The result more than realized these expectations.

The second collection made, comprised species of the pines, oaks, maples, elms, etc., from Florida, California, Indiana, Wisconsin, and Illinois, and not only do the results of the examination widely differ, but species of the same genus, in many cases, bear no relation to each other; the same species differ according to the conditions of the soil in which they grow, although, often times, separated by a distance of less than a mile, and, as has previously been pointed out, frequently assume coniferous characteristics.

To those who are not acquainted with the microscopical structure of woods, be it known that a radial and longitudinal section of any wood, presents markings on the cell walls, which are the subject of this paper. These markings, whether discs or simple dots, are thin places in the wall of the cell, and, with age, often become real perforations. They are directly opposite and correspond with the same thin places of the contiguous cell, and are undoubtedly designed for maintaining a ready conveyance of the sap from cell to cell; but, that in every species these cell-markings exactly correspond in size, shape and arrangement, making the determination of the species, under the microscope, infallible, or even possible, we cannot believe.

In the case of a slide before us, of the Pinus Strobus, or white pine, there are the characteristic discs of the order, which vary greatly in size and arrangement. On another slide we have a section of Quercus rubra, or red oak, showing similar markings, and somewhat confounding the statement made by a noted botanist, that the smallest fragment taken from a pine tree will at once discover the order.

We have two other slides of these same species, but growing under different conditions; the one growing in sandy soil and the other in rich alluvial soil. These do not show similar markings as do the other slides.

These four slides were selected from a collection of several hundred, all testifying to the truth of the foregoing remarks, and exhibiting a feature of which we have not spoken and upon which we hazard a theory, viz: That all those trees growing in sandy or dry soil, presented fewer and smaller cell-marks than those found in rich and moist ground. It is a known fact that the rock maple—acer saccharinum—yields sap in quantities depending upon the conditions of its growth, and in view of the fact that these cell-markings are the avenues by which the sap rises in the tree, it is our belief that they will vary according to the amount of sap flowing, which in turn depends upon the locality.

METHODS OF STUDY.

ALBERT E. JENKINS, ANN ARBOR, MICH.

FIXING AND HARDENING.

PICROSULPHURIC ACID. (KLEINENBERG'S FLUID.)

THIS is prepared by Dr. Mayer as follows:

Water, distilled, 100 vols.
Sulphuric acid, 2 vols.
Picric acid in crystals, as much as will dissolve.

This is the most extensively used of all the killing fluids; but it is especially valuable in embryological and invertebrate histological study. It may be used with good results everywhere except with objects possessing calcarious parts, as it dissolves all forms of calcium and precipitates it as crystal of calcium sulphate or gypsum, which render the object unfit for delicate sections. If it is desirable to use picric acid as a killing fluid on such an object it should be used alone as it thus retains the dissolved lime in solution; or picromitric acid, the formula for which appears on another page, may be employed instead. Picrosulphuric acid causes the connective tissue of vertebrates to swell, and this fact should be remembered in its use; the addition of creasote, which was proposed as a remedy for this undesirable feature, does not have any appreciable effect. Picric acid and all its combinations imparts to objects treated with it an intense and lasting yellow color which, unless quite removed, interferes with the ease and durability of the staining; and as it

requires a large amount of alcohol to remove even the excess of the acid it is an expensive reagent to use by those who have to buy their alcohol subject to the exceedingly high tariff of the United States.

It has many valuable features, however, which render it the most convenient and serviceable of all the many fluids now employed by investigators. 1st, by replacing the fluids of the object, its penetration is excellent and the tissue is quickly killed; 2nd, it preserves well the important features in each case, and no maceration takes place, even if the immersion is unavoidably prolonged; 3rd, it leaves the tissue in good condition for further treatment as it does not produce an insoluble or inorganic precipitate which mechanically interferes with staining, imbedding, etc.

CORROSIVE SUBLIMATE.

A saturated solution in water is made and glacial acetic acid in the proportion of two or three drops to the oz. is added. For round worms, leeches, molluscs, radiates, etc., it is used as above indicated; but for delicate embryos, flat worms, the visceral organs of insects, etc., it may be diluted one-third with water. The object should be placed in a relatively large quantity of the fluid and allowed to remain for from ten minutes to one hour, according to the size and nature of the specimen. The after treatment consists in thoroughly extracting the sublimate from the cells; and to do this well the piece should be placed in slowly flowing water for ten minutes to three hours. The author accomplishes this in the following manner: a beaker with an overflow is arranged with a syphon to supply it from a higher vessel; thus a constant current is maintained with no danger of injury to the most delicate tissues. For young embryos, blastoderms, etc., this serves the purpose well.

The washing completed the specimen is transferred to 50 per cent. alcohol, slightly acidulated with nitric acid, (1 drop to the oz.), for five minutes. The process is completed with pure 70 per cent. and then 90 per cent. alcohol.

This solution of corrosive sublimate may in difficult cases be used warm (60°–70° C); it thus kills instantly.

PERCHLORIDE OF IRON.

The ordinary alcoholic tincture of iron of the U. S. P. is di-

luted with 5–6 vols. of 70 per cent. alcohol, and if a precipitate forms either at the time of dilution or later add two or three drops of hydrochloric acid and shake well. With it very beautiful preparations of ciliated epithelum can be made in the following manner. A fresh trachea is opened and the above fluid slowly flowed over the inner surface, and then followed by 70 per cent. alcohol, to which has been added ½ oz. of oxalic acid, until the red brown color has changed to a yellow brown. The epithelium is then scraped off and mounted in glycerine. Delicate protoplasmic processes are also well preserved in the same way. If sections cut in a freezing microtome, or thin sections cut after the usual methods, be first treated with the iron and then with a weak solution of gallic acid an exquisitely shaded and durable iron stain in gray and black results. All objects treated with the iron must be very small as its action is limited to the surface.

Osinic acid is best followed by a very weak solution of ammonium carbonate, acetate of potash or picrocarmine. These, especially the two former, neutralize and remove all traces of the acid, and so prevent blackening. Nitric acid specimens may be treated with a 1 or 2 % solution of alum. Water should not be used after picric acid, only alcohol, and to facilitate the extraction of the acid and color, the bath may be placed in a warm chamber, (50°-60° C.).

HARDENING.

Alcohol, in various per centages of strength, is now the only fluid used to give to structures the necessary consistency for section cutting. It may be used after any killing fluid, a low grade first, and then successively higher ones. Specimens should, just before staining or embedding, be placed for one or two hours in 96 or 98 % alcohol, which I find answers as well as the more expensive absolute. The hardening of specimens should always be conducted at a low temperature, in summer in a cool cellar or refrigerator and in winter in a cool room. In any case, however, weaker alcohol than 70% should not be used more than 2 or 3 hours at a time, as maceration will almost certainly occur. To preserve specimens for future use, I find 85% alcohol to serve the purpose well.

SPECIAL METHODS.

DISSOCIATING ON MACERATING FLUIDS.

It is sometimes desirable to tease out a tissue to get the relations of one structure to another, as nerves and ganglia, muscles; to separate one element from extraneous matter, as spicules, crystals, etc., in the integuments of various animals, or to isolate cells for special study, as corneal and gland cells, muscle fibers, etc. For this purpose the entire object is placed in a fluid which breaks up the connection between different parts, but at the same time prevents any general decomposition and preserves the elements in a condition for study.

MÜLLER'S FLUID.

Bichromate of Potash,	25 grammes,
Sulphate of Soda,	10 grammes,
Water,	1,000 cc.

For macerating, this is to be diluted 2-4 times with water. In the strength given above, it is an excellent preservative fluid for the organs of the viscera and pathological specimens. The pieces used should be small and the fluid changed as often as it shows any turbidity. By its use a considerable saving in alcohol may be effected.

EAU DE JAVELLE (JAVELLE WATER).

Eight drops of this to 100 c. c. of water suffices in 24 hours to dissociate ganglia, nerve and muscle fibers, etc. It is a powerful oxidising and bleaching agent, and a most useful one to the microscopist, though but little known to the mass of workers. Alone or diluted slightly with water, it quickly cleans diatoms, and almost instantly removes the soft parts of sponges, leaving the skeleton of spicules intact. I know of no more beautiful object for a binocular than a rather thick section of a siliceous sponge, which has been cleaned with Javelle water. To the anatomist it is of equal value, as it makes beautifully clean and white skulls and small skeletons with no injury to the bones or any danger of a deposit.

NITRIC AND HYDROCHLORIC ACID.

These in a .25% solution, either alone or mixed, are used in preparing nerve cells, the unstriated muscle fibers in the intestine, uterus, etc., and the osteoblasts of developing bone.

CHALK AND BARYTA WATERS.

These are chiefly used in making preparations of tendons, and connective and elastic tissues. The first requires about 24, the latter only 6 hours.

POTASSIUM HYDRATE.

A trial with each case must decide the strength of the reagent to be used.

N. B.—In using an alkaline fluid, it is well to follow it with a very dilute acid, so that the actions of either may be certainly stopped at any desired point.

DECALCIFYING.

CHROMO-NITRIC ACID.

Chromic Acid 1%	70 vols.
Nitric Acid	3 vols.
Water	200 vols.

PICRO-NITRIC ACID.

Water	95 vols.
Nitric Acid	5 vols.

Picric Acid in crystals, as much as will dissolve.

In the study of developing bone or teeth, the soft parts of adult bone, and animals whose integuments are impregnated with lime (radiates, etc.), the fluids are indispensable in removing calcium so that sections can be made. Its action on the soft parts is to harden them and to preserve their every characteristic and relation, while the lime is dissolved and retained in solution. A large quantity of the solution should be used and renewed as often as it becomes exhausted, and to bring all portions of the acid in contact with the object, it should be frequently well stirred, with a glass or wooden rod; no metal should ever be placed in the bath. The specimens may be tested from time to time with a fine needle, care being taken, however, not to pass it through a part which it is desired to study. The above two fluids may de used on the fresh specimens as they are good fixatives, or the objects may be first killed and hardened and then decalcified. In all cases it is very necessary to completely extract the acid.

REMOVING SILICA.

This is done by immersing the well hardened specimens

(Sponges, Equisetums, etc.) in a dilute solution of fluoric acid, fluoride of ammonium. Only rubber or guttapercha vessels should be used for the bath, and exceeding care must be taken lest the fumes be inhaled or any fluid spilled on the hands, as it is a most corrosive poison.

IODINE.

A excellent reagent for the study of the central nervous system and ganglia is made as follows:

Iodide of potassium	6 grammes.
Iodine	4 grammes.
Water	100 cc.

If for any particular specimen the above solution is found too strong (e. g. if the outer parts are too deeply colored while the inner portions are but slightly acted upon), it may be freely diluted with water. After saturation the preparation should be hardened in alcohol in the usual manner. No staining is necessary as that has already been accomplished by the iodine, though for pathological study, especially with cancerous tissues, a slight staining with picro-carmine is advantageous.

HOT WATER.

In many instances, (e. g. insect and anstaceum eggs), a firm covering membrane so resists the action of reagents as ordinarily applied, that maceration takes place before the fluid has fully penetrated, and the specimen is ruined. In these cases recourse may be had to hot water or a two per cent. salt solution; it should be of a temperature not to exceed 80°–90° c., as the albumens of low organisms coagulate at a lower temperature than those of higher forms. It should be used but for a few minutes, and the egg hardened in the usual way with alcohol, beginning with 50 per cent. and finishing with 96 per cent. Of course the usual killing fluids might be used in the same way, but it is frequently impossible to fully extract them through the embryonic membranes and consistent integuments of many of the lower orders of life. Except in these cases hot water is of little service and but seldom used. Even in these cases it might better be replaced by

ACID ALCOHOL.

Alcohol alone as a killing fluid is objectionable inasmuch as it penetrates so slowly that the internal organs or portions frequently undergo extensive alterations before they come fully under the influence of the alcohol. When the stronger grades are used the water is so quickly taken up by the alcohol on account of the strong affinity of the two for each other, that precipitates are produced which interfere seriously with subsequent manipulations and give many impressions. At the same time the violent osmosis sometimes mechanically distends the tissues, and the cells on account of the rapid and unequal actions of this reagent, are almost always shrunken and the preparation valueless from a scientific point of view, for the true structure has been obliterated.

These difficulties may be in a great measure obviated by the use of the following mixture:

Alcohol, 7 per cent	97 vols.
Hydrochloric Acid	3 vols.

The object should be placed in this until fully saturated, and placed in pure 70 per cent. alcohol until the acid is extracted and stronger alcohol thus used to complete the hardening. Acid alcohol should only be made as used, as in time ethers are formed from the two separate reagents. This fluid may also be used hot, it is then most efficient with insects, crustacea, etc.

GENERAL REMARKS ON KILLING FLUIDS.

In preparing animal forms such as worms, leeches, embryos, blastoderms, etc., for microscopical study, they should be plunged alive into a large volume of the reagent selected, with crustacea and large forms generally, the body cavity should be freely laid open so that the fluid may have immediate access to every part; or if certain organs only are wanted their cavity may be flooded by means of a pipette. Or the fixative may be injected through the blood vessels, or the alimentary canal filled through a glass syringe.

All organs (liver, kidney, spleen, stomach, etc.) of the higher forms should be removed from the living or just killed animal and subjected to immediate treatment. Any structure of considerable size should be divided into small pieces so that

saturation may be speedily effected. A very sharp knife or razor must be used so that no part be crushed in the cutting, and a record made of the position and relation of each piece and attached to it by a thread; it is dangerous to trust the memory alone. Some excellent histologists do not cut the organ into pieces, but lay it open by deep incisions. If this is done they should be made as exactly as possible in the plane of the desired sections, as otherwise the difficulty of obtaining this and uniform sections is greatly increased. The actions of any reagent may be hastened by placing the bath in a warm chamber.

The acid or other mixture used in killing should be removed as soon as possible after its action is completed, which is when the specimen is perfectly saturated.

Chromic acid and its combinations may be partly removed by washing in water for from ten minutes to one hour by means of the apparatus described while speaking of corrosive sublimate. After this alcohol in successively higher grades should be used and this remark applies also to the final steps after other fluids have been used. The author uses alcohol of 30, 50, 70 and 95 per cents., using 70 per cent. until the acid is entirely removed from the specimens. With chromic acid this may be determined by the following test: An alcoholic solution of guaiacum, 1 part of the gum to 100 of alcohol, is made. If there remains any chromic acid in the specimen, a few drops of the alcohol last used upon it will show a blue coloration when added to the above solution. This reaction is very delicate, as by it one part of chromic acid to one million of solution may be detected.

GLEANINGS FROM THE JOURNAL OF THE ROYAL MICROSCOPICAL SOCIETY FOR OCTOBER.

C. H. STOWELL.

KEEPING BOTH EYES OPEN IN OBSERVATION.—Mr. E. M. Nelson says that the unused eye should be shut when the weaker light is in the microscope, both eyes being kept open only when the object is in the strongest light. By diffused daylight the light in the instrument is the weaker, and the other eye must

be shut. By artificial light in a dark room both eyes can be kept open. He then makes a statement that certainly does not accord with our experience. How does it with yours? He says, "One hour of steady hard work with the microscope by diffused daylight will tire you more than a whole day's work in a dark room by lamplight."

A POCKET FIELD MICROSCOPE.—Mr. T. Hippesley describes a pocket microscope that will magnify a hundred diameters and is very useful in the search for infusoria, etc. The instrument is made by bending a piece of thin metal five inches long by one-half inch wide into the form of the letter V; make two circular holes, one-tenth inches, one in each arm, opposite each other, so that when the arms are closed together by pressure the holes shall meet exactly. Now place a drop of water in one hole, taking care not to wet more than its interior circumference. The water will assume the form of a perfect double convex lens, of focal length, varying from $\frac{1}{8}$ to 1-10 inch. The end of one arm is bent inward so as to form a "stop," which when the arms are pressed towards each other to effect the focal adjustment, prevents a contact which would destroy the lenticular form.

PREPARING THE TAIL OF A PUPPY.—Harden the tail in alcohol for one week; soak in water; then place in a 1-6 per cent. solution of chromic acid, to every ounce of which add five drops of nitric acid; change this mixture frequently; when bone is soft soak in water and re-harden in alcohol; cut the sections and stain with carmine; fix the staining by adding mixture of five parts alcohol and one part hydrochloric acid; when scarlet, then wash in alcohol to remove acid and stain again in sulph-indigotate of soda, two drops to ounce of alcohol; let it remain here for four or six hours; then place in absolute alcohol, cleared in oil of cloves and mount in balsam.

TO PREPARE SECTIONS OF THE EYE.—The whole eye is placed in Müeler's fluid for 3 or 4 weeks, then cut with a sharp knife into two symmetrical parts, which are washed to remove yellow color. This may be hastened by placing them in a 1 per cent. solution of chloral for several minutes. They are now placed in ordinary alcohol for one day, and then transferred to absolute alcohol for another day. Sections are cut, after the tis-

sue has been imbedded in celloidin, stained with logwood or other stains, and finally mounted in balsam.

STAINING NERVES IN MUSCLE.—For small muscles place portions in a recent mixture of ½ per cent. alkaline solution of gold chloride, 1 grm.; 2 per cent. osmic acid, 1 grm.; water, 20 grm. Let the tissue remain in this mixture until the nerve ramifications can be seen; then in the following mixture: Glycerine, 40 grm.; water, 20 grm.; 25 per cent. hydrochloric acid solution, 1 grm.; for about a day. This prevents their becoming too dark. Thicker muscles are placed in a 2 per cent. solution of acetic acid for 12 hours, after which they are placed in a fresh mixture of ½ per cent. alkaline solution gold chloride, 1 grm.; 2 per cent. osmic acid, 1 grm.; 2 per cent. acetic acid, 50 grm. In this they remain for 2 or 3 hours, when they are transferred to the glycerine mixture given above. The nerve-end-plate is stained by this method.

THE CONSTITUENTS OF CLOUDS.—During a stay of three weeks on the Brocken, Herr Assman examined a number of slides on which drops of water had fallen. As the drops would fall on the slide they were carefully measured. The smallest drops had a diameter of .014 *mm.*, when spread on the glass. The largest were not above .018 *mm.* Lower down the mountain the drops were about .02 *mm.* Still further down the average diameter of the drops was about .035 *mm.* The smallest drops evaporated slowly in from 10 to 15 seconds under the microscope without leaving the slightest residue. At a subsequent examination with a temperature of 10° C. he noticed that very small drops of water fell on his slide; not a single crystal of ice or snowflake was visible among the drops. Nearly all evaporated quickly, and some few froze to ice of the same size.

EDITORIAL NOTES.

WE have for sale a fine Tolles 1-15 immersion lens, of superior quality. It cost the owner $150, and he is ready to sell it at 25 per cent. discount. Parties will please address us for particulars.

WE are in receipt of one of Chapman's improved moulds

for microscopical cells, also samples of cells made by this mould. The cells are very neat and must be quite inexpensive. The whole cost of outfit is only one dollar and a descriptive circular will be sent to anyone by addressing Geo. E. Ashby, 103 Maiden Lane, New York.

DR. GEO. DUFFIELD, of Detroit, is certainly wiser than many of us are in one respect at least. He says, in a recent circular, that while he has been glad, hitherto, to examine pathological specimens for his professional brethren without cost, he feels now compelled to charge a moderate fee for all such examinations, hoping thereby to get something "for time and materials consumed."

DR. JAMES, of the National Druggist, still continues to give us his valuable articles on Microscopical technology. Of late he has been telling us how to prepare, arrange and mount diatoms. There is one good thing about the Doctor's writings, he knows what he is talking about.

OUR MICROSCOPICAL LABORATORY is the richer by the recent arrivals of four "Ideal" stands, from Mr. Walmsley, of Philadelphia; two histological stands, from Mr. Bullock of Chicago; one stand from Mr. Gundlach of Rochester, and ten low power objectives from the same house.

AT this writing there are two hundred students, in the University, engaged in microscopical work. Before the close of the college year the number will be more than doubled.

SELECTIONS.

CLEANING SLIDES—A VALUABLE DISCOVERY.

Old and damaged slides are generally handled by microscopists are a first-class nuisance, and a question that has frequently been asked in the microscopical journals is, how shall they be cleaned? Until very recently, I have advised boiling them in concentrated lye, but I have recently hit upon a much better plan. I take a wide-mouthed jar, of sufficient depth, and half fill it with a mixture of gasoline or benzine, spirits of turpentine and benzol. The slides are dropped into this and left

over night, or until it is convenient to wipe them. When ready to do this, take out each slide separately, and give it a good, hard wipe with a piece of muslin or domestic, and then polish with another clean bit of the same stuff. Try the plan once, and you will never use any other. A jar such as is used for preserved fruits, holding from 12 to 14 fluid-ounces, is just the thing. Slides thoroughly cleaned thus, possess a quality which, in making glycerin or aqueous mounts, is absolutely invaluable. While they are optically and practically clean, such slides retain upon their surface an exceedingly tenuous film of resinous matter that prevents water or glycerin from attaching itself to the surface, and the consequence is that the surplus of such fluid, after a cell is closed, rolls off the slide without moistening it in the least. Cement, on the contrary, attaches itself with extraordinary firmness and evenness.—*Dr. James, in the National Druggist.*

THE KOCH COMMA-BACILLUS.

This much-discussed little body receives still further attention in a lengthy article in the *Medical News*, August 29, 1885, by Dr. Hermann M. Biggs. After covering the ground very thoroughly, the author terminates his paper with the following conclusions:

1. That Koch's claims as to the discovery of a germ peculiar to cholera, which possesses certain morphological and biological characteristics, that differentiate it sharply from all other germs, have stood the test of investigation by many observers, and remain yet to be disproved.

2. It is acknowledged by all investigators, without exception, that the Koch comma-bacillus is always found in Asiatic cholera in greater or less numbers, and that it is absolutely diagnostic of cholera, whether it bears any etiological relation to the disease or not.

3. That, although it cannot be considered as absolutely proven that the Koch comma-bacillus is the cause of cholera; yet its constant presence in this disease, and its absence under all other conditions, its relation to the course and intensity of the disease processes, and its peculiar life history, constitute very strong presumptive evidence in this direction,

4. Whatever may be the ultimate conclusion of medical men on this question, that still the greatest honor is due to Dr. Koch for having placed at our disposal a method for the diagnosis of Asiatic cholera.—*Medical and Surgical Reporter.*

PATHOGENIC GERMS IN HEALTHY BLOOD.

The Paris correspondent of the *British Medical Journal* tells us that M. Chauveau, at the Grenoble meeting of the Association for the Advancement of Science, exposed some facts which warranted the belief that the blood of healthy people contains pathological germs, which only require favorable conditions to exhibit their properties. M. Verneuil endorsed this view, and observed that, even when in a condition of apparently perfect health, we are, nevertheless, a sort of menagerie, or hot-house, containing a mass of germs, which develop when a wound or injury provides them with the opportunity. M. Ollier instanced recurring osteomyelitis as a proof of the truth of MM. Chauveau and Verneuil's theories. Sometimes, after an interval of ten years, osteo-myelitis re-appears. The microbes remain inert until aroused by a provocative, but the disease re-appears each time in a milder form, suggesting that the micro-organism becomes attenuated by remaining in the human organism.—*Medical and Surgical Reporter.*

TABLE OF COLOR-CORRECTIONS.

	WITHIN FOCUS.	WITHOUT FOCUS.
Under correction.	Brick red.	Greenish Blue.
Slightly under, but a large number of the finest lenses have this color.	Claret.	Light Green.
Nearly colorless—shows the *secondary spectrum.*	Lilac.	Paler Green.
Over-corrected.	Blue.	Yellow.

—*Microscopical Bulletin.*

CONTROVERSIAL.

Said Koch: "I've some comma baccilli;"
Said Klein: "I don't think they will kill;" "I,"
Said Finkler (and Prior),
"Believe he's a liar;"
Said Ferran: "I can knock you *all* sill-i."
—*New York Medical Record.*

THE "TIMES" ON THE MICROSCOPE.

The following leading article appeared in the *Times* of the 26th August:

"We publish this morning an article descriptive of some of the progress which has been made during late years in the construction and cheapening of Microscopes and of their accessory apparatus—a progress so marked that it has become time for all who are engaged in the work of construction to consider carefully to what extent the improved instruments of the present day can be employed for the furtherance of the general work of teaching. If we may adopt Paley's definition of education, as "comprising every preparation that is made in our youth for the sequel of our lives," we shall be prone to admit that few of these preparations can be of greater importance, or of greater ultimate utility, than the training of the eye to observe natural phenomena, and the training of the mind to appreciate the meaning of these phenomena and their relation to one another. It was a great day during the childhood of many who have now passed the meridian of life when the lecturer with an oxyhydrogen Microscope was announced as being about to exhibit and to discourse at the town hall; and the huge transparency in which the insect life of a drop of water was displayed in full activity became a wellspring of new thoughts and increased mental activitv to nearly all of those who gazed in wonder at the presentment of rapid movement, of abounding life, and of continual destruction. The sight which was then to be seen only on rare occasions, and as a sort of entertainment, is now at the daily command of every schoolmaster, or of every parent who can spare only a small amount of money, and who possesses sufficient intelligence and mannual dexterity to learn the use of the instrument which, more than any other, has led to increased

knowledge of the structure of man and animals, and to modern improvements in the healing art. The powers now at the disposal of the *savant* far surpass any which were attainable only a few years ago; but the use of these high powers requires the devotion of such a lifetime to the study of learning how to see, and how to interpret what is seen. No persons are more certain to fall into gross errors than the untrained possessors of powerful Microscopes; and the conduct of actual research, of the business of carrying knowledge a step in advance of its former boundaries, must always be limited to the few. When, in 1854, the late Dr. William Budd announced that cholera was dependent upon tthe presence of a minute intestinal fungus, there were probably not three observers in England who were capable of pronouncing a trustworthy opinion as to whether a given speck was a microscopic fungus or not; and there was no doubt that the so-called 'fungi' of many persons were nothing more than fine particles of chalk, derived from medicine which had been administered to the patient. Since that time vast strides had been made in the methods of conducting such investigations, together with corresponding improvements in the instruments by which they are conducted; and almost every beginner now thinks himself qualified to prattle about microbes. In the case, unfortunately, of those who may be presumed to be the most skilled observers, talk and observation do not always seem to be conducive to agreement.

It is not, however, for the sake of prosecuting original inquiry, but for the sake of making known to the young what has already been established, that the Microscope should commend itself to educationists. It reveals and displays plainly to the sense of sight two great facts—the fact of the wonderful complexity and beauty of the structure of the smallest and apparently the most insignificant creatures, and the fact that all living things of appreciable magnitude, whether they be plants or animals, are built up by the aggregation of myriad of minute organisms or cells, each of which possesses independent life, and each of which fulfils a purpose in the corporate body by its own inherent and independent activity. If a Microscope is given to children as a toy, and if all that is done for them is to permit them to look through it at something the nature of which they

do not understand, it will do them no more good than seeing a conjuring trick, perhaps hardly so much; but if children are encouraged to examine first the more simple vegetable structures, making their own sections and proceeding gradually from low powers to higher ones, from coarse to minute and complex structures, they can hardly fail, if capable of enlightenment at all, to obtain such new notions of the universe in which they live as will never wholly cease to influence their minds. The lore actually gained may perhaps be comparatively small; but the true gain will be in the power to think about occurrences, to discover real resemblances between things which are externally different, and to perform that wonderful work of ratiocination through which two ideas, similar or contrasted, become the parents of a third. It is difficult to believe that a child who was not only permitted to work with a Microscope, but who was assisted to do so in a rational way, encouraged to collect his own objects, to examine them in his own fashion, to try to overcome his own difficulties and doubts, would ever grow up into an entirely stupid man or woman. There are but few who are gifted with the infinite patience and the love of truth for its own sake which form the raw material, so to speak, of the philosopher; but the instances are at least equally few in which the lessons in observation and reflection, which even a small Microscope is calculated to afford, would not serve to raise the mind of the user to a higher level, and to develop a higher degree of intelligence than could have been obtained without such help.

In a few very good schools, chiefly for the children of the more wealthy classes, natural history teaching by the aid of Microscopes is systematically conducted, the classes collecting their own specimens, and being expected to give the best account they can of them before being assisted towards a better one by the teacher. Our argument is that all this should be done much more widely and generally; education, in fact, being made to advance along a road which is rendered comparatively smooth by the perfection of modern appliances. The tasks of school, in too many cases, appeal to the memory rather than to the understanding, and cultivate stupidity rather than intelligence. It is impossible to doubt that much which is taught, say in Board schools, might be relinquished without any appreciable loss to

the intellectual development of the scholars, and that by such relinquishment time might be gained for instruction of a more fruitful kind. As for the material, even in towns, it is present in immeasurable abundance. There is a legend that an ardent naturalist once determined to write a complete account of the plants and animals which he found in Lincoln's-inn-fields, but that the magnitude of the task was such as to place insuperable obstacles in the way of its accomplishment. An attempted history of the insect life alone was abandoned for the same reason; and a second Gilbert White might have found ample occupation in observing and recording the habits of the various denizens of the narrow space. It is, perhaps, too much to hope that the officials of a public department will ever so far emancipate themselves from the trammels of routine as to take the initiative in the promotion of better nature teaching; but it is not impossible that they might learn to follow if they were clearly shown the way. The parochial clergy in old times were the pioneers of improvement on all educational questions; and there is no reason why they should seek to regain something of the leadership which had to so great an extent slipped away from their grasp. Could they not, especially in rural districts and in country towns, do something towards the promotion of a reform which would render the younger members of their congregation more observant, more thoughtful, more careful of animal life, less ready to be over sure about problems the solutions of which are not yet known to mankind, but on which so many people are prone to be dogmatic in precise proportion to their ignorance? The modern Microscope might form one of many levers by which the minds of future generations might be guided towards the attainment of knowledge and the cultivation of modesty and charity."

STAINING FOR MICROSCOPICAL PURPOSES.

In further continuation of his excellent articles, Dr. H. Gierke deals with (1) the treatment of specimens with various metal salts, such as chloride of palladium, oxide of iron, &c. (2) Staining methods in which carmine is combined with other reagents, e. g. picric acid, indigo-carmine, and metal salts. (3) Methods in which logwood is used in combination with various

other reagents. (4) The combination of anilin dyes with each other and with metal salts. (5) The combination of the gold and silver methods. Not the least important and interesting part of the articles is the historical description of the development of the employment of anilin dyes in staining technique, commencing with mauvein and fuchsin in 1856. The author well observes that those who are engaged in histological research with the aid of staining materials should be thoroughly acquainted with the chemistry of the dyes with which they work, and a description is given of the source, manufacture and properties of the anilin dyes as well as alixarin, logwood, indigo, carmine and others.

In his concluding article, Dr. H. Gierke has drawn up elaborate tables respecting the anilin pigments. The first table gives the ordinary nomenclature, chemical formulæ, remarks on the solubility, reaction, and preparation of the various anilin stains. The second table, arranged according to colour, gives the solubility in water or alcohol and the behaviour with acid and alkalis.

The rest of the paper is chiefly occupied with a discussion as to whether, when a preparation becomes coloured, the colour is due to imbibition of pigment, or is the result of chemical changes effected in the tissue by the pigment. The author maintains that though histological staining depends for the most part on the physical processes of diffusion and imbibition, the occurrence of chemical combination in staining cannot be denied. On the contrary, such combinations are of frequent occurrence and, as micro-chemical reactions, are of the greatest importance. The histological stain, so far as it imparts a permanent dye, depends on the physical process of surface attraction. Chemical processes should be suspected when a pigment is discharged or changes to a different shade. We may, therefore, speak of chemical processes when one and the same pigment stains different tissue elements of a preparation in different ways. Double staining by the simultaneous or consecutive use of several dyes only in parts depends on chemical processes. In greater measure they are effected by the unequally developed attraction-force of various tissues. It is also shown by the fact that one pigment is able to remove another from certain tissue elements, but not

altogether from the same preparation. If a section of any organ, rich in various tissues, be laid in a mixture of several pigments, each histological element is stained by that for which it possesses the greatest attraction. If a certain part have for two or more dyes an exactly similar attraction, it then takes up both or all, and a mixed colour is the result. Examples of staining by chemical processes are, among others, the various reactions on amyloid substance. When Curshmann employed methyl-green for staining amyloid-degenerated nerves, all the normal parts were coloured green, the hyaline cylinder light blue, and the amyloid substances violet. The latter, therefore, entered into chemical union with the pigment, the new body only showing a colour differing from that of the dye. Thus, too, the rose-orange staining of red blood-corpuscles by rosin may be regarded as the result of a chemical reaction.

The author concludes by expressing the opinion that the staining problem of the future will be solved by the aid of chemical reaction.—*Journal of Royal Society.*

REVIEWS.

THE ESSENTIALS OF HISTOLOGY. By E. A. Schafer, F. R. S., Professor of Physiology in University College, London. Octavo volume of 246 pages. 281 illustrations. Cloth, $2.25. Lea Brothers & Co. 1885.

The chief object of this excellent work is to give the student of histology directions for the microscopical examination of tissues. The illustrations are similar to those found in the second volume of the ninth edition of Quain's Anatomy, the histology of which was written by this same author. The work is divided into forty-three lessons, each lesson supposed to occupy from one to three hours. The author gives us only those methods of work which have proved successful in his hands, and therefore all the more valuable. It is a valuable acquisition to our microscopical library and will become a work of daily reference. It is brief, concise and clear in all its statements. It should be in the hands of every worker in animal histology.

METHODS OF RESEARCH IN MICROSCOPICAL ANATOMY AND EMBRY-

OLOGY. By Charles Otis Whitman, M. A., Ph. D. 8 vo. pp. 260. Illustrated. Boston: S. E. Cassino & Co. 1885.

The contents of this work are arranged in two parts; the first embracing the methods of a more general character, as preservative fiuids, dyes, fixatives, mounting media, embedding, etc.; while the second part includes special applications of embryological, anatomical, and histological methods.

This introduction of special methods must be regarded as highly valuable to working histologists, and especially embryologists; for it is a fact that heretofore the student in embryology has had but little help from any text-book, his sources of information being obscure and practically inaccessible.

It can be positively asserted that here the embryologist will find just such help as he has long been wishing for, and the publishers need only to call attention to this feature of the work to insure for it a good sale. It will also be a great aid to all workers engaged in any branch of microscopical anatomy.

SYNOPSIS OF LECTURES ON ANIMAL PHYSIOLOGY. By Henry Sewall, Ph. D., Professor of Physiology in the University of Michigan. Second edition, revised. 8 vo. pp. 136.

The chief object of the author has been to present a skeleton of his lectures in such a manner that the attention of the student may be fixed upon the main facts of the subject. The topics, therefore, "serve as points of departure in the lecture room." While the work was essentially written solely for those who listen to the author's lectures, yet the ground covered is so complete that it might well be regarded as representing the most recent views on physiological subjects, presented in a terse, compact manner.

THE CENTURY.

This interesting monthly holds its place as the first of its kind in America. The November number is rendered exceedingly interesting for many reasons: "Chattanooga," from "Personal Memoirs of U. S. Grant," is the leading article in the war series. "Gen. Grant at Mt. McGregor," is illustrated with a full page cut of Gen. Grant, taken on June 15, 1885. There is also "a letter from General Grant to his physician," fac-simile written July 2, 1882. "A Photographer's visit to Petra"; "A Cloud

on the Mountain," and many other equally interesting articles make up No. 1 of Vol. XXXI.

PHYSICIAN'S VISITING LIST FOR 1885. P. Blakiston & Co., Philadelphia. Thirty-fifth year of publication.

This is a very complete visiting list, containing the almanac, table of signs, poisons and antidotes, weights and measures, dose table, together with the usual "visiting list." It is neatly bound in morrocco, and even a pencil is included.

THE LIFE AND TIMES OF WILLIAM LLOYD GARRISON. By his Sons. Comprising a History of the Anti-Slavery Movement in America, and touching upon the leading Reformatory Schemes of the first half of the present Century—the Total-Abstinence Movement, the Doctrine of Peace, the Non-Resistants, Woman Suffrage, etc., etc. 1805–1840.

This work, composed by Wendell Phillips Garrison, literary editor of the *Nation*, and his brother, Francis Garrison Jackson, is in form a strictly personal narrative; but the relation of the editor of the *Liberator* to the anti-slavery agitation which he began in 1831, and directed to the close of the war and the downfall of the slave system, was such that the story of his life is necessarily the story of the cause. For the history of this movement in the United States, this biography must always be the standard work of reference, but it has many other permanent claims upon public attention. The period in which Mr. Garrison rose into prominence as an abolitionist was remarkable for the number of reformatory schemes which simultaneously appeared, and for the millennial hopes which attended them. By virtue of his profoundly religious nature, Mr. Garrison represented this aspect of his time more completely and strikingly than any other individual. His career was peculiarly romantic and at times dramatic, and the recital of it possesses the interest of a novel and is full of inspiration.

The work is fully illustrated with portraits, etc., and, at present, two volumes are offered to the public, covering the life of Mr. Garrison during its most eventful period.

Price: In cloth, $5.00 for the two volumes. For sale by C. W. Arnold, 329 Warren Ave., Detroit, Mich.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

WANTED—One copy of each of the following numbers of Phin's Journal of Microscopy. Vol. I., No 1; Vol. III., Nos. 2 and 7; Vol. IV., Nos. 5 and 6. Will give a well mounted and interesting microscopic object per copy for any of the numbers wanted.
M. S. WIARD, New Britain, Conn.

5 VEGETABLE slides, double-stained, new method, formulæ and short process for preparing them, all for $3. J. D. BECK, Liberty, Pa.

FOR EXCHANGE—Zeitschrift fur wissenschaftliche Mikroskopie, Volume I., 1884. Would prefer type-slides of diatoms in exchange. Address,
A. B. AUBERT, Orono, Penobscot County, Maine

FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

FOR EXCHANGE—Eleven varieties of unmounted starches (including Calabar Beans, Ginger, Calchicum, Tous les Mois, etc.,) for one mounted slide objects pertaining to vegetable histology preferred. C. F. BOOTH, 278 Greenwich St. N. Y. City.

SEEDS of Orthocarpus Purpurascens and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well cleaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED—Microscope stand and microscopical books and journals. Will give various articles or cash for same, Send for list. C. VON EIFF, Jr. 347 Greenwich St., New York City.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

EXCHANGE.—Parties having diatomaceous earths or other microscopical material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow, Msss.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

HISTOLOGICAL SLIDES, very thin and evenly cut, well mounted and well ringed, will be exchanged for Pathological or Histological slides only.
H. L. WHITNEY, M.D., German Hospital, Philadelphia, Pa.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

FOR SALE.—Slides, double stained, of Bacillus Tuberculosis, 50c. each.
DR. W. R. CHITTICK, 83 Lafayette Avenue, Detroit, Mich.

WANTED.—Books treating on microscopical and histological subjects not already in my possession. Will pay cash, or give slides in exchange. State name of the work, date of issue, and price. C. H. STOWELL, Ann Arbor, Mich.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M. D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

PATHOLOGICAL, Histological, and other well mounted slides will be exchanged for mounted specimens of interest. Lists furnished on application.
D. E. HAAG, M.D., Liberty Center, Henry County, Ohio.

FOR SALE OR EXCHANGE—A Student Microscope and Objectives.
E. L. CHEESEMAN, Knowlesville, N. Y.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

PATHOLOGICAL, Histological and Miscellaneous Mounts, will be exchanged for mounted specimens or material. H. W, WESTOVER, M. D., St. Joseph, Mo.

THE MICROSCOPE.

VOL. V. ANN ARBOR, DECEMBER, 1885. No. 12.

ORIGINAL COMMUNICATIONS.

A STUDY OF HUMAN BLOOD.

C. H. STOWELL.

IF a drop of blood be placed on the slide, the cover glass applied, and the preparation transferred to the microscope, the examination is anything but satisfactory. The number of corpuscles in the field is so great and the number of layers so many that the specimen cannot be studied to advantage. Again, if mixtures are used to dilute the blood, unless prepared with the greatest care, they will cause changes in the corpuscles. When but a comparatively short examination is required the following method will be found satisfactory: To procure the drop of blood, one of the fingers is congested by tying around its base a string or handkerchief. When well filled with blood a fine cambric needle is quickly thrust through the outer coats of the skin over the end of the congested organ. One surface of a glass slide is now gently breathed upon and a drop of blood freshly pressed from the puncture, is brought in contact with this slightly moistened surface. One surface of the cover glass is now breathed upon and immediately its edge is placed close to, just in contact with, the edge of the drop of blood. With the aid of a needle the cover is lowered away from the drop,—not over it,—until it touches the slide. The blood corpuscles will readily flow between these moist glasses, by capiliary attraction, until the surface beneath the cover glass is nearly or entirely covered.

There is but one single layer of corpuscles and they show to the best possible advantage. For this method to be successful it should be carried out rapidly and the moisture should not

be in excess, lest the water cause some change; it should be sufficient however, to allow the corpuscles to flow readily under the cover. The amount of moisture to be imparted by the breath is soon learned after a trial or two. If desired, a layer of oil may be placed around the cover glass and thus prevent the drying of the specimen.

Examined with a magnifying power of about 450 diameters one never fails in a specimen prepared as above to see most beautiful and perfect representations of the rouleaux, where a greater or less number of red corpuscles adhere together by their flat sides.

Another satisfactory method of obtaining a thin layer of blood is to draw the edge of a smooth glass slide over the fresh blood and then drawing this edge of the slide across the flat surface of another slide. The thin cover is at once applied and the specimen examined.

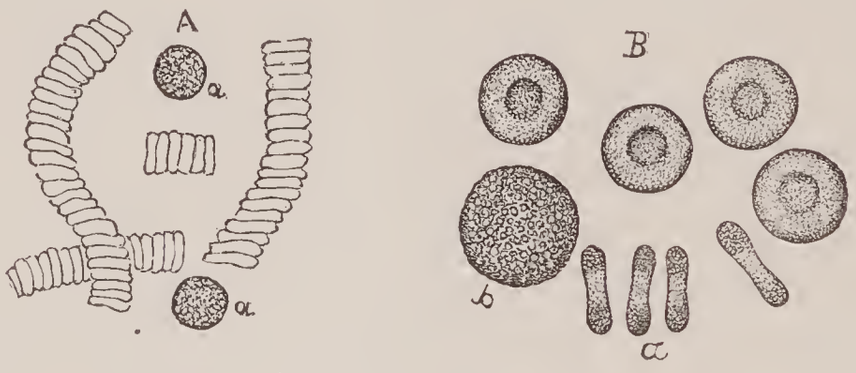

FIG. 1.—A. Human red blood-corpuscles in rouleaux. a, white corpuscles. x 400.
B. Human red blood-corpuscles. a, seen on edge. b, white corpuscle. x 1000.

THE RED CORPUSCLE.

1. *The Rouleaux.*—Prepared according to the first method, as already stated the first thing noticed is the arrangement of the red corpuscles into rows. It is rather difficult to explain why the corpuscles so arrange themselves. One author says that if a number of circular corks be taken and cut comparatively thin, and made concave to represent the red corpuscle in shape; and if a pin be placed in the edge of these corks and a weight, as a bullet, attached to the free end of the pin; and if a number of these corks thus prepared be put into a tub partly filled with water and the water agitated, of course the corks

will float around freely, on their edge. It is soon noticed, this writer says, that the corks will come together in rows, with their concave sides together just as we now see the so-called rouleaux of human blood. Another writer says that on the outside of the red corpuscles there is a glutinous substance and that this holds the corpuscles together in rows, and they assume this particular arrangement because they take up less room that way. It certainly must be true that this glutinous substance alluded to does not exist during the circulation of the blood, for it is a well known fact that the red corpuscles flow freely in the centre of the stream in the blood vessels, while the white ones flow much more slowly, clinging to the walls of the vessels as if they indeed were somewhat glutinous in their nature.

2. *Their Shape.*—After noticing the rouleaux, a slight tap on the edge of the cover glass will separate the corpuscles and they can now be studied to advantage. The shape of the red corpuscle is seen to be circular, and, watching some as they float about turning frequently on their edge, biconcave with rounded edges.

3. *Their "optical delusions."*—The corpuscles act with reference to the light as biconcave lenses, hence when the objective is slightly within the focus, the centre of each corpuscle appears light, and when slightly without the focus the center appears dark. This led the old observers to regard the centre as a nucleus. They were, we say, "optically deluded." The shape is readily altered by various reagents to be mentioned later.

4. *Their Color.*—When seen in mass, or in a number of layers under the microscope they present a reddish color; but when seen alone, or in a single layer, they are of a yellowish-green color.

5. *Their Structure.*—They appear to have no enveloping membrane, only the outer part of the corpuscle seems more dense than the inner part. No nucleus is visible without the use of reagents, and none is visible with the use of any ordinary reagent. For a discussion of this question our readers are referred to our large manual.

6. *Action of Reagents.*—Water has the effect of changing the red globules to a spherical form. Many times the central depression of one side will disappear before it does on the other, giving them a peculiar cup-shaped form; finally the water dissolves out the coloring matter, the corpuscles become paler and paler until after a time they are totally disintegrated. Acetic acid brings these changes with great rapidity. The alkalies are very active in dissolving their whole substance. A 1 p. c. solution of salt will cause the red corpuscles to assume the crenate or horse-chestnut form, in which their surface is covered with minute spinous projections. This same appearance is seen in corpuscles that have been exposed to the air a short time. This may be due to the loss of carbonic acid by the plasma, the corpuscles then loose carbonic acid themselves and this is followed by a shrinking of part of the stroma. Tannic acid, in a 2 p. c. solution causes the hæmoglobin to collect at the periphery in the form of one or more small refractive buds.

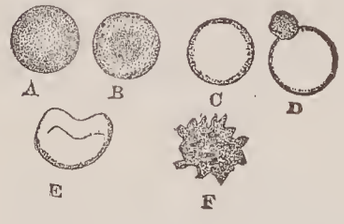

FIG. 2—*Human red blood-corpuscles.* A, when slightly within the focus; B, when viewed slightly without the focus; C, E, after the addition of water; D, after the addition of tannic acid; F, after the addition of salt solution. x 600.

These peculiar buds are explained as follows: The tannic acid, like many other reagents, causes the coloring matter to separate from the stroma, as the separated coloring matter passes out of the corpuscle it becomes coagulated by the acid, in the form of round, granular-looking bodies. All reagents are best applied by placing a small piece of blotting paper to one edge of the cover and a drop of the reagent to the opposite edge. The reagent will be readily drawn under the cover and thus the specimens will be "irrigated."

THE WHITE CORPUSCLES.

These bodies never enter into the rouleaux as do the red. They do not roll about so readily. They are larger than the red. By "irrigating" the specimen the red corpuscles can be all washed away, while the white will remain. They appear as highly transparent bodies, dotted with minute granules. In each corpuscle there is one nucleus; many times two or three nuclei.

HOW TO PERMANENTLY PRESERVE.

If desired to mount a specimen of blood a slide should be prepared according to the second method given above. When the blood is dry the slide is transferred to the turn-table and a shallow ring of cement placed upon it; the slide is now gently warmed and the cover-glass applied at once and sealed in place. Or a slide, prepared as above, can be exposed to the fumes of a one per cent. solution of osmic acid for a few minutes, until the corpuscles are colored and then mounted in balsam.

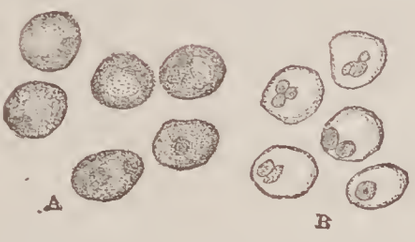

FIG. 4—Pus. A, before, and B, after the action of dilute acetic acid. The pus corpuscle resembles the white blood-corpuscle.

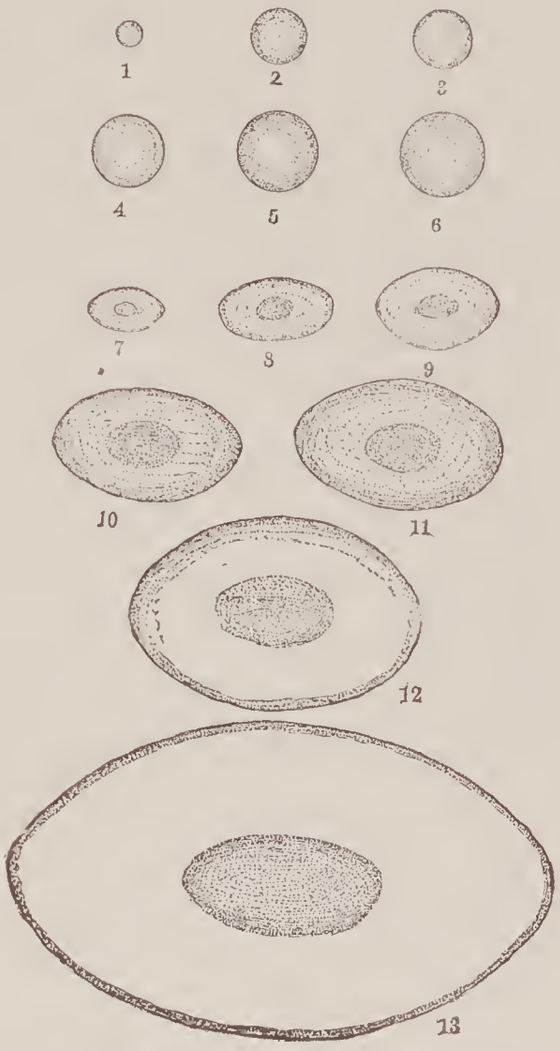

FIG. 3—Showing relative size of red blood-corpuscles of different animals. 1, musk-deer, 2, horse, 3, mouse, 4 man, 5, whale, 6, elephant, 7, humming bird, 8, pheasant, 9, pigeon, 10, snake, 11, crocodile, 12, triton, 13, proteus.

MICROSCOPICAL SOIREE.

THE annual Soireë of the Biological and Microscopical Section of the Academy of Natural Sciences, Philadelphia, took place at the hall of the Academy on the evening of December 3d, and in all respects was the most successful and interesting one ever made by the section. In the main hall or library and in the alcoves surrounding it, upon numerous and well-lighted tables were arranged nearly two hundred microscopes by various makers, American and foreign; on the stages of which were displayed an infinite variety of objects in the mineral, vegetable and animal kingdoms, illuminated by all the different methods, best calculated to show their various structures and beauties. Each instrument was presided over

by an attendant who patiently explained the subject under view, to each of the attendant guests, numbering some two thousand, as they eagerly thronged about the various tables. A noticeable display was made by the Biological Laboratory of the University of Pennsylvania, in the shape of some thirty microscopes, presided over by as many students, who exhibited specimens of their own work, in section cutting, staining, etc. The display made by the manufacturers and dealers was also noteworthy; especially that of Messrs. W. H. Walmsley & Co., who exhibited a complete assortment of all the instruments manufactured by the Messrs. Beck; from their grand International Binocular, costing $1,500.00 to the lately introduced "Star," at $25.00; as well as an endless variety of accessories and apparatus for preparing, mounting and illuminating specimens. Probably such a display of apparatus was never before made at any soireë given by this old and flourishing society.

Another novel feature, was the display in the large east room, by Mr. Walmsley of a large number of lantern slides made by him from Photo Micrographs; both negatives and positive being on gelatine dry plates. One hundred and twenty slides were shown, during as many minutes, by means of the superb dissolving lanterns of Mr. Frank Bennett, who not only loaned them for the occasion but managed them throughout; thus insuring the success of the exhibit. The subjects embraced a great variety of mineral sections, crystals, spores, pollen, wood sections, and other specimens belonging to the vegetable kingdom; desmids, spores, Algæ, whole insects and insect parts, sections of hairs, bones and other animal parts. Each was briefly and clearly explained by Mr. Walmsley, as one picture dissolved into the next, and the whole display was received with cordial marks of approval.

The museum was also brilliantly illuminated and thrown open to the guests, so that in spite of the very large number assembled, there was no uncomfortable crowding at any one point.

WE still hold the Tolles 1-15 objective mentioned in our last issue.

HOW TO MAKE PHOTO-MICROGRAPHS.

BY W. H. WALMSLEY.

SECOND PAPER.

WITH whatever form of microscope employed a camera of some description is a necessary adjunct, and there is scarcely any limit to the style or form that *may* be employed; though the desirable ones are few in number. The late Col. Dr. Woodward made use of his dark room as a gigantic camera. The sun's rays without were reflected by an enormous heliostat through suitable condensers into the microscope and thence to a frame work (travelling upon a railway) which carried the focussing screen and sensitized plate; the rest of the room being in total darkness. But such appliances are beyond the reach of most workers, and it is therefore needless for us to consider them further. A modified form of the same apparatus may be employed with lamp light, by using two rooms and carrying the light through an opening in the partition between them; but this involves trouble and expense, which may be saved by employing a camera of suitable form, which is the method most generally in use, and is that recommended by the writer.

My first photo-micrograph was made with a very simple and crude apparatus, but one thut proved sufficiently effective to turn my attention earnestly toward the possibilities of this method of recording observations made with the microscope; which instrument had for many years been a source of recreation and study, during my leisure evenings. Many and many a time had I longed to perpetuate some of the wonders and beauties revealed by the magic lens, but want of skill as a draughtsman made caricatures of all my attempts with the pencil. Dr. Woodward's magnificent photographs, and those by several other celebrated workers were familiar to me; exciting my envy and admiration, but the appliances wherewith they were produced were quite beyond my reach, and no literature on the subject that I had ever seen threw any available light upon it.

Like many another, I had dabbled a little in photography, upon the introduction of gelatine dry plates, my outfit consisting of a so-called pocket camera, by Walker, the inventor of the

present Eastman film roll holder. This camera was merely a cubical box of about four inches square, and without bellows; the focussing being effected by sliding the tube carrying the lens within an outer one. The size of the sensitive plate was $2\frac{3}{4} \times 3\frac{1}{4}$ inches, very small, but the lens being adapted to the plate. I had received many pleasant souvenirs of the departed summer's "outing," by its aid; which in the winter's evenings now returned were pleasant to look upon. During one of these evenings whilst working with the microscope an object of such extreme interest came under observation that an irresistible desire to draw or photograph it seized upon me. The former I could not do acceptably; what about the latter? Could my little box be utilized for the purpose? Would the light of my lamp be sufficient if the camera could be made to answer? Upon carefully examining the latter I found that the outer tube in which the one bearing the lens was slid, exactly fitted on the end of the eye-piece of the microscope, when the cap of the latter was removed. The instrument was inclined at an angle of about 45° just comfortable for convenient use, and the object under observation was brilliantly illuminated by a German student's lamp. Without other change than slipping the cap from off the eye piece, the camera box, (from which the lens and tube had been removed) was made to take its place; and on the ground glass screen a well defined and lighted image of the specimen was seen. A slight alteration of the focus was necessary to secure the crispest definition, but there was no doubt thus far of the success of the experiment. A plate holder, containing a sensitized plate, was substituted for the ground glass, the light was cut off from the microscope, the dark slide withdrawn from the holder; all was ready for the exposure. Then the question arose what length of time must be given? I was absolutely in the dark as to this most important matter; knew nothing whatever about the relative actinism of sun and lamp light, indeed was so new to photography that I really *knew* nothing of the subject at all. Manifestly only experiment could determine the proper time. The object was the eyeless flea of the mole; a rather dense mass of brownish yellow chitine, yet transparent withal, and showing the tracheal vessels within, quite distinctly. The objective was Beck's $1\frac{1}{2}$ inch of the first-

class series, the ocular No. 1 or A, any the light, (as previously stated) that of a student's lamp, reflected by the concave mirror. The plate was one of Carbuth J. C. B. brand, at that time the quickest of any in the market. *Five* minutes was the length of exposure determined upon and given, and the result (with ferrous oxalate development) was a most excellent negative, which is now lying beside me, and which (en passant) is "*not for sale*," being my first born. Beside it lies another and far better negative from the same object, made recently with identically the same apparatus and fixtures in *one* and a half minutes; the saving in time being due to the employment of the more sensitive plates now made by the same maker, and alkaline pyro development. Another negative from the same subject also lies beside the others, made in *one* minute with the same lens, and lighting, but employing a comera with a bellows, that permitted the banishment of the eye-piece, and this latter negative is incomparably finer in every particular than either of the others. It will thus be seen that in making my first photomicrograph an eye piece *was* employed, although as stated I never use one now.

Subsequently Dr. F. W. Mercer, of Chicago, without any previous knowledge of my initial attempt, devised a similar form of camera which may be used upon any microscope large enough to carry it, with or without employing the eye-piece as desired. This camera is now being made by the Scovile Manufacturing Company in their usual masterly workmanship, and is sold at a very moderate price. For quickly producing a faithful and permanent image of an object under examination, without any change being required in the microscope or illumination, it serves a most useful purpose; but its field of usefulness as well as that of view, being extremely limited, it can only be recommended as an ajunct to a better camera.

More recently Mr. H. F. Atwood, of Rochester, devised an ingenious combination of a microscope and camera, which may be briefly described as follows: A cone shaped box about thirteen inches in length, carries at the larger end a focussing screen and plate holder for plates, $3\frac{1}{4}$ x $4\frac{1}{4}$ inches. At the smaller extremity is permanently attached a simple form of microscope stand without eye-piece, and provided with the so-

ciety or universal screw. The focussing adjustment is worked by a rod passing beneath the box to the rear end where it is attached to a milled head. In use the instrument is placed horizontally upon a table, with a lamp behind the stage of the microscope, the light being condensed upon the object by means of an ordinary bulls eye condenser. The arrangement will be made clear by a wood cut to be given in the next of this series of papers. The merits of this form of apparatus are its simplicity and cheapness; the demerits, great unsteadiness, rendering it useless for high powers, and the inability to vary the amount of magnification without change of objectives; there being no bellows or other arrangement for lengthening or shortening the tube.

GLEANINGS FROM OUR EXCHANGES.

C. H. STOWELL.

THE BINOCULAR MICROSCOPE.—W. B. Carpenter says that there is one curious thing about the binocular microscope, it increases very greatly the focal depth. He has tried this under every condition and has always found this to be so. He says this is partly explained by the binocular prism halving the aperture of the objective. This does not wholly explain it however; for he says he asked a friend once to look through the binocular with one eye only, the prism being in its place, and to focus the objective for what he considered to be a medial distance; on then asking him to open the other eye, the difference in the depth of focus was at once observed; it was considered that the increase amounted to at least five times. Prof. Carpenter says he has consulted with some of his friends on this subject, but could never come to any satisfactory conclusion.—*Queckett Club.*

The Microscope in the School-Room.—The writer says that no one, who has not tried it, can form an adequate conception of the mental quickening occasioned by showing a few selected slides to classes in the school-room. Such specimens as the scales on a butterfly's wing, the eye of a common insect, grains of sand, the circulation of the blood, etc. Thus by reaching the mind through the eye a lasting impression is made; such an impression as books and diagrams could never produce. He

further says that there ought to be a microscope, and a good one too, in every school in the land.—*N. Y. Jour. Mic.*

Staining Axis-Cylinders of Medullated Nerve-Fibres.—Dr. Kupffer says the axis-cylinder contains the nerve-fibrils floating loose in nerve-serum. A compact axis-cylinder is an artificial production. To demonstrate this he stains the nerve for 24 hours in a ½ per cent. solution of Osmic acid, and after a thorough washing, stain with a saturated solution of acid fuchsin. A transverse section will show the axis-cylinder fibrils as stained points.

Staining Desmids.—When quite fresh, wash and place in a solution of chromic acid, so weak that it requires three days to decolorize a large desmid. When the color has gone, wash in water and stain with anilin. Fix with tartaric or weak nitric acid; then wash and mount in camphorated or carbolized water. All fresh-water algæ seem to do well treated in this way.—*W. B. Turner.*

Volvox Globator, Keeping Alive and Mounting.—Mount in a mixture of equal bulks of alcohol, water and glycerine. They can be double stained by using a mixture of osmic acid, anilin-green, magenta, and Häntsche's fluid.—*English Mechanic.*

Properties of Malleable Iron.—The strength of a finished piece of iron depends on the sectional area of the mass of iron it contains. From a total sectional area of weld iron the slag conclusions, and in the case of ingot iron the blow-holes, must be deducted. As yet, however, microscopy has not advanced far enough in this field to be of great service.

Color of Birds' Eggs.—Both the ground color and the spots are derived from the blood and not from special pigment glands. The ground color is caused by a transudation through the uterus which is richly supplied with blood vessels. The spots are formed by particles of pigment which are found throughout the oviduct and probably arise in the Graafian follicle; the formation of pigment is no doubt to be referred to a process similar to that which causes the corpus luteum in the ovary of mammals.—*Zool. Anzeig.*

Action of Cocaine on Invertebrates.—An injection of hydrochlorate of cocaine stops the heart of a snail in diastole; the animal will recover from a dose of .003 gr. An earthworm soon has the middle part of its body rendered insensible by the injection of a dose of .006 gr., but the two sides retain their power of movement. Daphniæ resist for a long time the action of the drug. Hydræ in 5 c. c. of water to which 1 c. c. of the solution was slowly added died in an extended state. The author suggests that for these and for Bryozoa this drug be used as enabling us to preserve these delicate animals in an extended condition.

Curved Bacilli.—Hericourt finds curved bacilli, same form as Koch's cholera bacillus, in all water no matter what its source. Neutral bouillon and potatoes were sterilized and inoculated with dust from various places, and many curved bacilli developed in all the cultivations. Intestinal dejecta in simple diarrhœa, dysentery, typhoid fever, in all diseases of the lungs, these curved, comma-shaped bacilli were present.—*Comptes Rendus.*

EDITORIAL NOTES.

"NO OTHER JOURNAL LIKE IT."—Thus one of our warmest friends wrote us not long ago, and thus one of our opponents said also. The latter intended to complain, but he only succeeded to compliment. Our journal is different from any other published in the world, and we intend to maintain our individuality for another year at least. This is about all we have to say for our "prospectus for 1886." We are going to conduct the journal another year with the sole idea of giving our readers the crispest and latest news in the microscopical world.

IF, however, our readers desire to get the most for their money, we must insist upon their sending us prompt renewals. We fear our subscribers do not understand how important this is to us. The matter is so small to each person that it is delayed until even months pass by. If you wish to help us; if you are at all interested in getting a good journal; if you intend to renew for 1886, then please send us one dollar before the first

of January. We are already in receipt of a number of renewals, and are ready for many more.

WE have a number of sets of Vol. III., less No. 1, or the April number for 1883. We will credit any one 25 cents if they will send us a copy of this missing number.

The volume on hand, without this number, contains 196 pages of reading matter, embracing all the departments of general microscopical literature. Many of our readers have never seen these numbers. We now offer to send this amount of reading matter to anyone who will mail to us any of the following numbers:

1882.	December number.	1884.	September number.
1883.	April number.	1885.	February number.
1884.	January number.	1885.	August number.
1884.	July number.		

THE MICROCOCCUS OF DENGUE.—Dr. J. W. McLaughlin, President of the Texas Microscopical Association, has made some observations on the blood of patients suffering from Dengue, and claims to have discovered the "true germs" of this disease. He describes them as "small, circular or oval bodies of a reddish hue, encased in a darker outline, and about the one-twentieth to the one-thirtieth of the side of an ordinary red blood-corpuscle." The discoverer describes the germs as "occupying the red corpuscles in great numbers," a condition of things, very remarkable to say the least; for we were not aware before that these minute germs had ever been found in the blood-corpuscles, in any condition of life or in any disease of the individual.

The same germs were also found abundantly in the atmosphere. Commenting on the above discovery, a Texas editor proudly asks, "who knows but what a Texas physician may place within the grasp of science," etc., to which we reply, "Yes. We suppose it is *possible*, even for a *Texas* physician to thus place his discovery, provided science wishes to grasp it.

But science is getting a little cautious these days about grasping all the germ theories that are thrown into her hands. We think she has grasped a few that she is already loosening her hold upon. This would not be such a serious matter but it so happens that when she lets go one of these theories it always

falls with tremendous force on the heads of its discoverer and chief advocates.

ALL of which,—will our readers forgive us?—leads us to publish the following: "One of the most atrocious things of the season, is reported by the *Medical Record* of a Dr. Samuel W. Francis, who says that squinting is due to the presence of micro-cock-eye."

WE are in receipt of a dozen slides from Dr. F. O. Jacobs, of Newark, Ohio, which are the very best, of their kind, we have ever seen. Each slide represents a complete section of a tooth, with the enamel all in proper condition and with the pulp preserved and stained. We understand Dr. Jacobs is preparing to place his new freezing microtome on the market.

WE were very much surprised to learn that Dr. F. L. James, of St. Louis, had severed his connection with the *National Druggist.* Our readers have often noticed extracts in our columns from this journal, and the extracts were well worth reading too. The *National Druggist* has become known to hundreds of microscopists and physicians, through Dr. James connection with it, who would otherwise have remained entirely ignorant of its existence. We are glad that journal and its readers will be the only losers, for Dr. James will continue to give us his crisp notes as heretofore, only for another periodical. Our readers can get his writings by sending for the *St. Louis Medical and Surgical Journal;* and this is the best free ad. we have given any medical journal in a long time.

MR. GRIFFITH has just issued another circular describing his microscope, turn-table, lamps, etc. A list of one hundred purchasers and owners is given as an endorsement of the good qualities of this instrument, and certainly no better endorsement could be given. The circular will be sent to any person requesting it.

WE desire to call particular attention to the new "ad." of Mr. Walmsley, for the "Star" microscope. A number of our readers will remember seeing this pattern at the Cleveland meeting. It is a good deal of a microscope for the money and we advise our friends who are looking for a low priced instru-

ment to examine this model closely. Mr. Walmsley will send circulars to all who request it.

SELECTIONS.

MICROSCOPICAL EXAMINATION OF CILIATED ORGANISMS BY INTERMITTENT LIGHT.

BY GEORGE M. HOPKINS.

Every observing person has noticed that moving objects appear stationary when viewed by a flash of light; examples of this are seen during every thunder storm occurring in the night. The wheels of a carriage, a moving animal, or any moving thing, seen by the light of the lightning, appears perfectly stationary, the duration of the light being so brief as to admit of only an inappreciable movement of the body while illumination lasts.

If by any means a regular succession of light flashes be produced, the moving body will be seen in as many different positions as there are flashes of light. If a body rotating rapidly on a fixed axis be viewed by light flashes occurring once during each revolution of the body, only one image will be observed, and this will result from a succession of impressions upon the retina, which by the persistence of vision become blended into one continuous image. In this case no movement of the body will be apparent; but if the flashes of light succeed each other ever so little slower than the rotatory period of the revolving body, the body will appear to move slowly forward, while in reality it is moving rapidly; and should the light flashes succeed each other more rapidly than the revolutions of the revolving body, the body will appear to move slowly backward, or in a direction opposite to that in which it is really turning. These curious effects are also produced when the number of the light flashes is a multiple of the number of revolutions, or *vice versa*.

The combined effect of interrupted illumination and persistence of vision may be practically utilized for examining objects under motion which could not otherwise be satisfactorily

studied. To apply intermittent light to the microscopical examination of ciliated organisms, the writer has devised an electrically rotated aperture disk, which is arranged to interrupt the beam of light employed in illuminating the object to be examined.

The instrument consists of an electric motor of the simplest kind mounted on a plate having a collar fitted to the substage of the microscope. The shaft, which carries a simple bar armature before the poles of the magnet, also carries upon its upper extremity a disk having two or four apertures, which coincide with the apertures of the stage and substage two or four times during the revolutions of the disk.

The shaft carries a commutator, and the course of the current from the battery through the instrument is through the spring touching the commutator, through the shaft and frame of the instrument to the magnet, thence out and back to the battery. There are two methods by which the speed of rotation of the aperture disk may be varied; one is by plunging the elements of the battery more or less, and the other is by applying the finger to the shaft of the motor as a brake, the motor in the latter case being started at its maximum speed, and then slowed down to the required degree by the friction of the finger. Experiment shows that the period of darkness should be to the period of illumination about as three to one for the best effects. Closing two diametrically opposite holes in the disk secures about the correct proportion.

Various rotifers examined by intermittent light showed the cilia perfectly stationary. The ciliary filaments of some of the infusoria, Vorticella and the Stentor, for example, when viewed by intermittent light, appeared to stand still, and their length seemed much greater than when examined by continuous light. The interrupted light brings out not only the cilia around the oral aperture, but shows to good advantage the cilia disposed along the margin of the body. What interrupted light may reveal in the examination of flagellate or ciliated plants the writer is unable to say, as no objects of this character have been available. It is presumable, however, that something interesting will result from the examination of Volvox and other motile plants, by means of this kind of illumination. Although

it is necessary to interrupt the beam of light regularly, for continuous observation, the effect of intermittent light may be exhibited to some extent by an apertured disk like that above described, twirled by the thumb and finger or revolved like a top by means of a string; or by using a larger apertured disk fitted to a rotator, and placed between the source of light and the mirror of the microscope.—*Scientific American.*

DR. JOHNSON ON MICROBES.

All anticipation of future knowledge and suggestions which those who come after find to be correct, have a peculiar kind of interest and are worth noting, even though the scientific basis on which they are founded may be questionable. There is an observation of Samuel Johnson's on the subject of dysentery which fairly illustrates this. In a letter to Mrs. Thrale, dated November 12, 1781, he says: "If Mr. ——— will drink a great deal of water, the acrimony that corrodes his bowels will be diluted, if the cause be only acrimony; but I suspect dysenteries to be produced by animalculæ, which I know not how to kill." Johnson used the word "animalculæ;" a modern writer would say "microbes."—*N. Y. Med. Record, 1885.*

THE MICROSCOPE FOR OCTOBER.

The leading article in the *Microscope* for October is from the pen of Mr. Walmsley, of Philadelphia, and is the first of a series on "photo-micrographs," and, it is safe to say that all who have the pleasure of knowing the author, and of having seen his superb work in the line on which he writes, will read the communication very closely. It is admitted on all sides that Mr. Walmsley has no superior in this department of microscopical technology. Professor Marshal D. Ewell, of the Union College of Law, Chicago, contributes a well written description of the ruling machine of Professor Rogers, of Harvard University, and of the method employed by that great American expert in ruling standard micrometers. Dr. Allen Y. Moore, of Cleveland, gives the result of a critical study of the work of a 1-18 oil immersion objective of Zeiss, as compared with a Spencer 1-10, and as was to be expected by all who have had any

opportunity of testing the work of the two men, preference is given in every respect to the American objective. Dr. Moore closes his article by reiterating the words of the *National Druggist* (for which I was so sharply taken to task last summer): "I am fully satisfied that the best objectives made anywhere are made in the United States."—*F. L. James.*

REVIEWS.

MARVELS OF ANIMAL LIFE. By Chas. F. Holder, author of "Elements of Zoology," etc. Illustrated, 240 pages, 8 vo., $2.00. Handsomely embossed binding. Chas. Scribners' Sons, New York, 1885.

It is becoming a fact that a large number of the holiday gift books are of a scientific character. An effort is being made by very many writers to present natural objects to young people in such an attractive way that they are incited to visit woods and streams, and thus become investigators themselves. As the author aptly puts it "the way to study the sword fish is to go sword-fishing." So the proper way to study natural history is to become an original worker, and thus derive pleasure and profit from personal observation. Such subjects as the fishes, the dry land fishes, the sea-serpents, animal mimics, wonders of the air, etc., etc., are written upon in a most charming manner. The illustrations are very good also. It is just the book for young people.

WONDER STORIES OF SCIENCE. By Rev. D. N. Beach, Amanda B. Hains, Mary W. Fisher, James L. Bowen, and others. Illustrated. pp. 430. $2.00. Handsomely embossed binding. D. Lothrop & Co. Boston, 1885.

This book is a collection of articles on such popular topics as always serve to interest the general reader. It tells how Christmas cards are made, how gloves are made, how newspapers are made, how fish-hooks, umbrellas, combs, dishes, lace, etc., are made. It is a book, therefore, that is not only highly entertaining but also very instructive to all those not already familiar with such subjects. It is a book that comes from the

press just in time for us to take advantage of it for the holiday season. We cannot have too many such works as these. What better reading can we have for the household?

THE USE OF THE MICROSCOPE. By Dr. Carl Friedlaender, of Berlin, Translated by Henry C. Coe, of London. Second edition, enlarged and improved. Large 8 vo. pp. 200. D. Appleton & Co., New York.

In this work we find a brief description of the microscope and its accessories, followed by quite a complete account of reagents used in general work. Methods of preparing tissue are briefly given, while the examination of fluids is given to some length. The work is somewhat elementary in character and contains those methods in general and well known use. Yet they are collected together here in a convenient and compact manner, thus making the work of value to all as a work of reference and of especial value to the beginner who is not as yet in possession of a complete library on microscopical technique.

THE CENTURY.

Our readers will be very much interested in reading an article on "Dangers in Food and Drink" which appears in the December number of this journal. It tells of the wide spread use of adulterants in our foods and dangers in our water supplies. There is an instructive and highly entertaining article by Mark Twain on "A Campaign that Failed." War articles and other interesting matter make this an exceedingly interesting number.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

ONE-TENTH immersion. adjustable obj. by Gundlach, for sale.
HAROLD PLOWE, 136 High st., Peoria, Ill.

WANTED—A Microsterioptieon in exchange for a first class 1-10 Immersion Objective.
WM. C. BRITTAN, 11 Washington Ave., Detroit.

FOR EXCHANGE—A Hartnack 1-11 objeetive, 170°. Will exchange for a good low power glass.
A. Y. MOORE, 67 Euclid Ave., Cleveland, Ohio.

FOR EXCHANGE—One Fiddian Mieroscopic Illuminator, one Brass injecting Syringe with four pipes and stop cock, one Microtome (Brass) Rivet, Improved, with knife, one Dr. Seilers Section Knife and Carrier, one warm Stage with Thermometer and Gas Chamber in exchange for first class Polariscope with goniometer Eyepiece or collcction of thin mounted Rock sections.
DR. HENRY FROEHLING, 17 South 12th street, Richmond, Va.

LIBRARY

WANTED—One copy of each of the following numbers of Phin's Journal of Microscopy. Vol. I., No 1; Vol. III., Nos. 2 and 7; Vol. IV., Nos. 5 and 6. Will give a well mounted and interesting microscopic object per copy for any of the numbers wanted.
M. S. WIARD, New Britain, Conn.

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5 VEGETABLE slides, double-stained, new method, formulæ and short process for preparing them, all for $3. J. D. BECK, Liberty, Pa.

FOR EXCHANGE—Zeitschrift fur wissenschaftliche Mikroskopie, Volume I., 1884. Would prefer type-slides of diatoms in exchange. Address,
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FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

FOR EXCHANGE—Eleven varieties of unmounted starches (including Calabar Beans, Ginger, Calchicum, Tous les Mois, etc.,) for one mounted slide objects pertaining to vegetable histology preferred. C. F. BOOTH, 278 Greenwich St. N. Y. City.

SEEDS of Orthocarpus Purpurascens and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well cleaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED--Microscope stand and microscopical books and journals. Will give various articles or cash for same, Send for list. C. VON EIFF, Jr. 347 Greenwich St., New York City.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg. Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

EXCHANGE.—Parties having diatomaceous earths or other mieroscopieal material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow. Msss.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

HISTOLOGICAL SLIDES, very thin and evenly cut, well mounted and well ringed, will be exchanged for Pathological or Histological slides only.
H. L. WHITNEY, M.D., German Hospital, Philadelphia, Pa.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

FOR SALE.—Slides, double stained, of Bacillus Tuberculosis, 50c. each.
DR. W. R. CHITTICK, 83 Lafayette Avenue, Detroit, Mich.

WANTED.—Books treating on microscopical and histological subjects not already in my possession. Will pay cash, or give slides in exchange. State name of the work, date of issue, and price. C. H. STOWELL, Ann Arbor, Mich.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M. D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

PATHOLOGICAL, Histological, and other well mounted slides will be exchanged for mounted specimens of interest. Lists furnished on application.
D. E. HAAG, M.D,, Liberty Center, Henry County, Ohio.

FOR SALE OR EXCHANGE—A Student Microscope and Objectives.
E. L. CHEESEMAN, Knowlesville, N. Y.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

PATHOLOGICAL, Histological and Miscellaneous Mounts, will be exchanged for mounted specimens or materia[illegible]. H. W, WESTOVER, M. D., St. Joseph, Mo.

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THE

MICROSCOPE

AN ILLUSTRATED

MONTHLY JOURNAL.

EDITED AND PUBLISHED BY

CHAS. H. STOWELL, M. D., F. R. M. S.,
Professor of Microscopy and Histology, Univ. Mich.

LOUISA REED STOWELL, M. S., F. R. M. S.,
Assistant in Microscopical Botany, Univ. Mich.

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By WILLIAM ROBERTS, M. D., F. R. S., Physician to the Manchester Royal Infirmary and Professor of Clinical Medicine to Owens Medical College:—

"If properly prepared, Malt Extracts are rich in Diastase, and have a high power in digesting starchy matters. But you will be surprised to learn, as I was, that a large proportion of the Malt Extracts of Commerce have no action on starch. Out of 14 trade samples of Malt Extract examined by Messrs. Dunston and Dimmock, *only three* possessed the power of actingon starch. These brands were MALTINE, Corbyn, Stacy & Co's Extract and Keppler's Malt Extract'—*British Medical Journal.*

Prof F. CHITTENDEN, of Yale University:—

"'Maltine' far exceeds in diastatic power any of the six preparations of malt which I have examined. Ten grains of 'Maltine,' warmed at 63-65° C., for fifteen minutes with 125 grains of starch in five oz of water in the form of paste, formed from the starch 7.43 grains of sugar, calculated as dextrose. Ten grains of Trommer's Extract of Malt, under similar conditions, formed during the same length of time 1.47 grains of sugar, calculated as dextrose."

Prof. ATFIELD, F. R. S., F. I. C., F. C. S., etc.:—

Oct. 8, 1883.—"I now find that 'Maltine' contains from three to five times as much diastase as any Extract of Malt in the market."

Prof. WALTER S. HAINES, A. M., M. D.—:

Rush Medical College, Chicago, Dec. 13, 1883.—"'Maltine' will convert a much larger amount of starch into sugar than any of the Extracts examined, and I therefore regard it as the best Malt preparation with which I am acquainted."

Prof. ALBERT B. PRESCOTT, M. D., F. C. S.:—

Univ. Mich., Jan. 7, 1884.—"'Maltine' converts 33 times its weight of starch. Trommer's Extract of Malt converts 16 times its weight of starch."

Prof. R. DORSEY COALE, Lecturer on Chemistry and Toxicology:—

Univ. of Maryland, Baltimore, Md, Feb. 7, 1884.—"I obtained in the open market, from four different wholesale dealers in this city, samples of 'Maltine' and Trommer's Extract of Malt, and have subjected them to chemical analysis to determine the relative diastatic value of these preparations. From result submitted, it will be seen that 'Maltine' is far superior in converting power. A given weight of 'Maltine' formed into sugar 1.819 gramme, while the same weight of Trommer's Extract Malt, under exactly same conditions, formed .898 gramme.

CHARLES HARRINGTON, M. D., Harvard University:—

"Comparing 'Maltine' with Trommer's Extract of Malt, I find after a series of comparative tests, that 'Maltine' possesses double the converting power of Trommer's preparation. A given weight of 'Maltine' converted twice the amount of starch that the same weight of Trommer's did, and in less time."

Dr. STUTZER, Director of the Imperial Chemical Agricultural Laboratory for Renish Prussia, Bonn.

Germany. Dec. 1, 1883.—"As to diastase 'Maltine' is far superior to the best Extracts of Malt I have ever seen."

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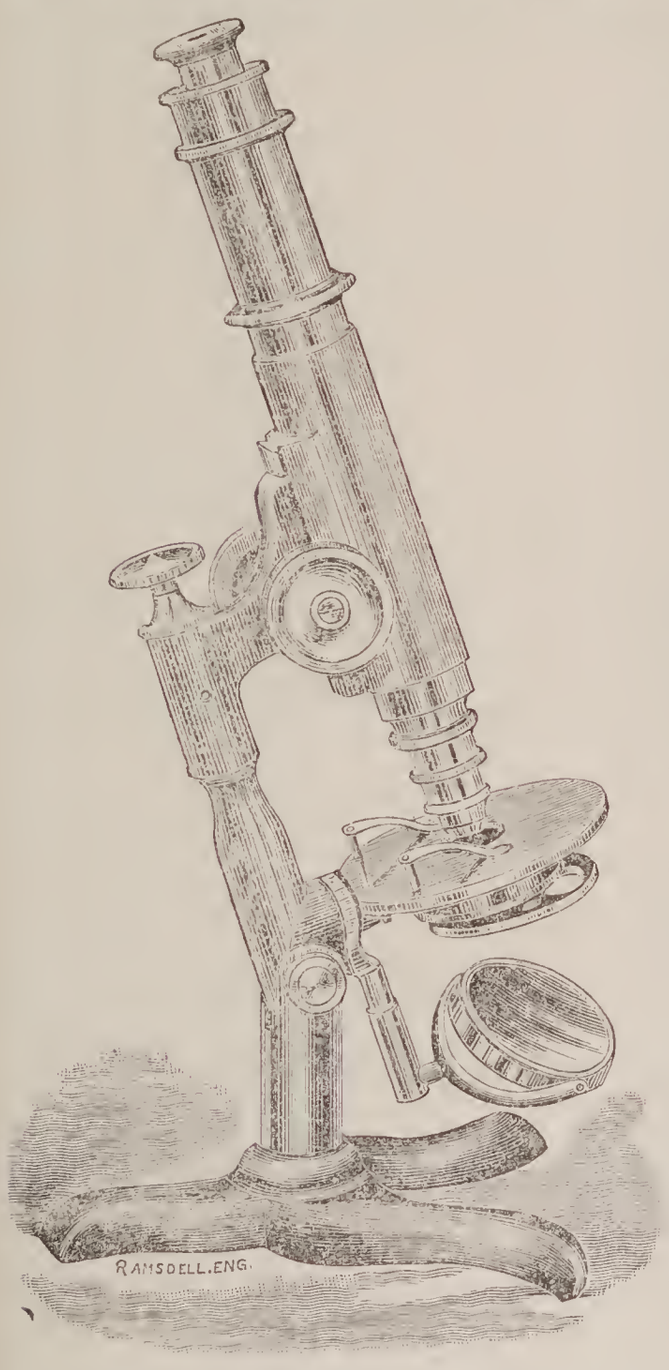

The Nonpariel Microscope

This instrument is designed to furnish a very complete microscope at a very low price. It is handsome and of good workmanship. The foot, pillar and arm are of iron, neatly japanned. The foot is a tripod of new design. The stand has a good rack and pinion, and micrometer screw adjustment. The latter is worked by a milled head on the top of the pillar. The pillar has an inclination joint which permits the body to come nearly to a horizontal position.

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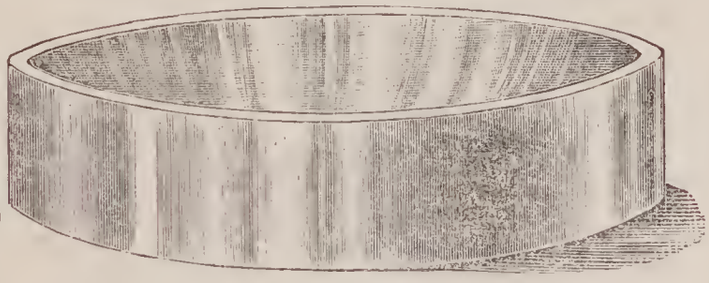

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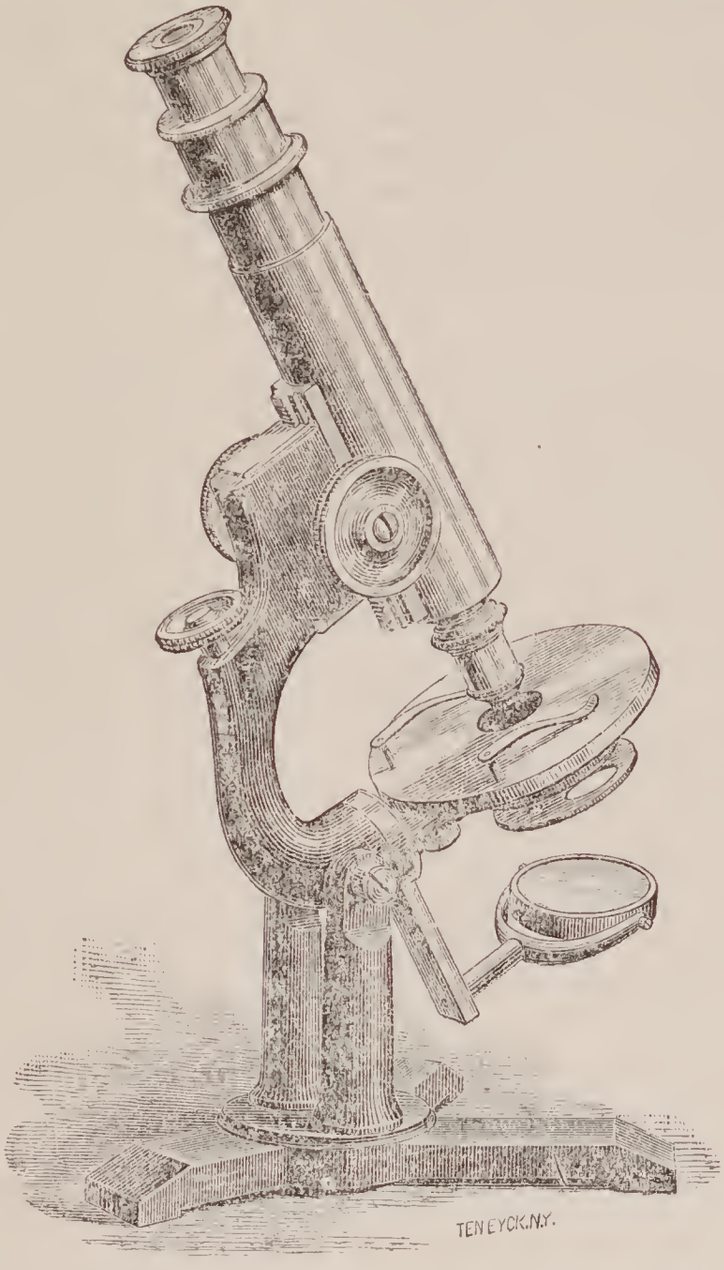

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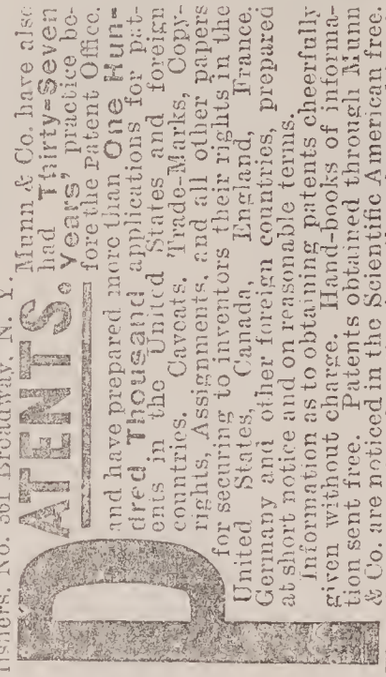

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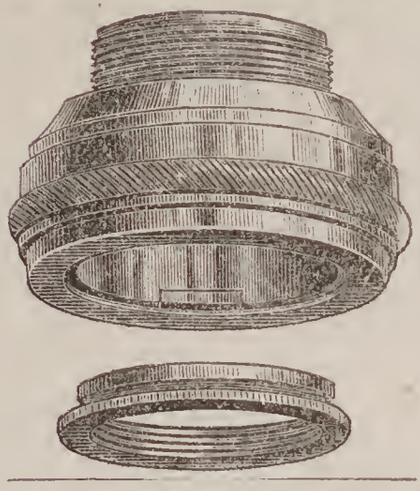

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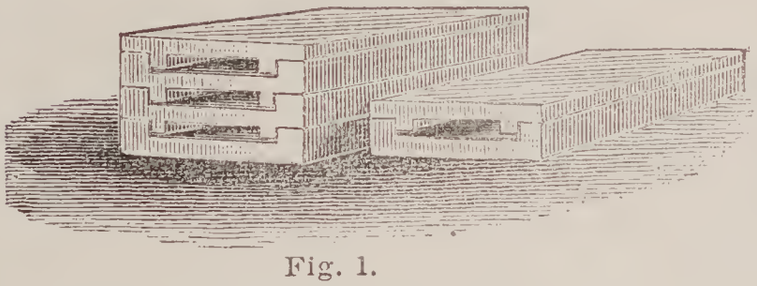

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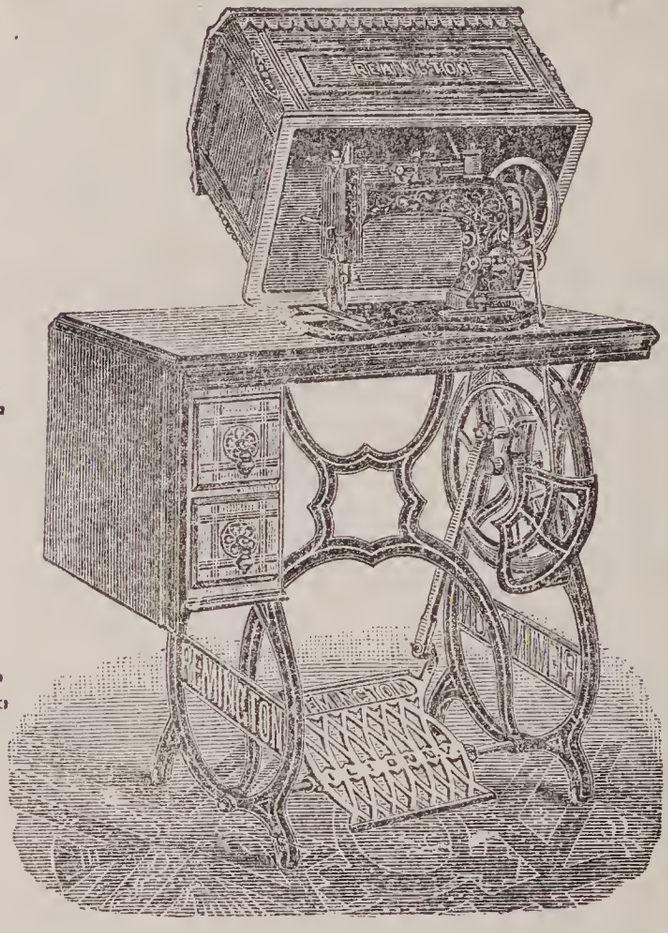

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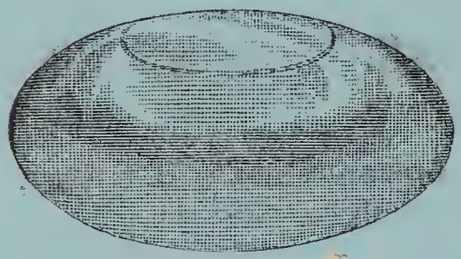

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Professor of Microscopy and Histology, Univ. Mich.

LOUISA REED STOWELL, M. S., F. R. M. S.,
Assistant in Microscopical Botany, Univ. Mich.

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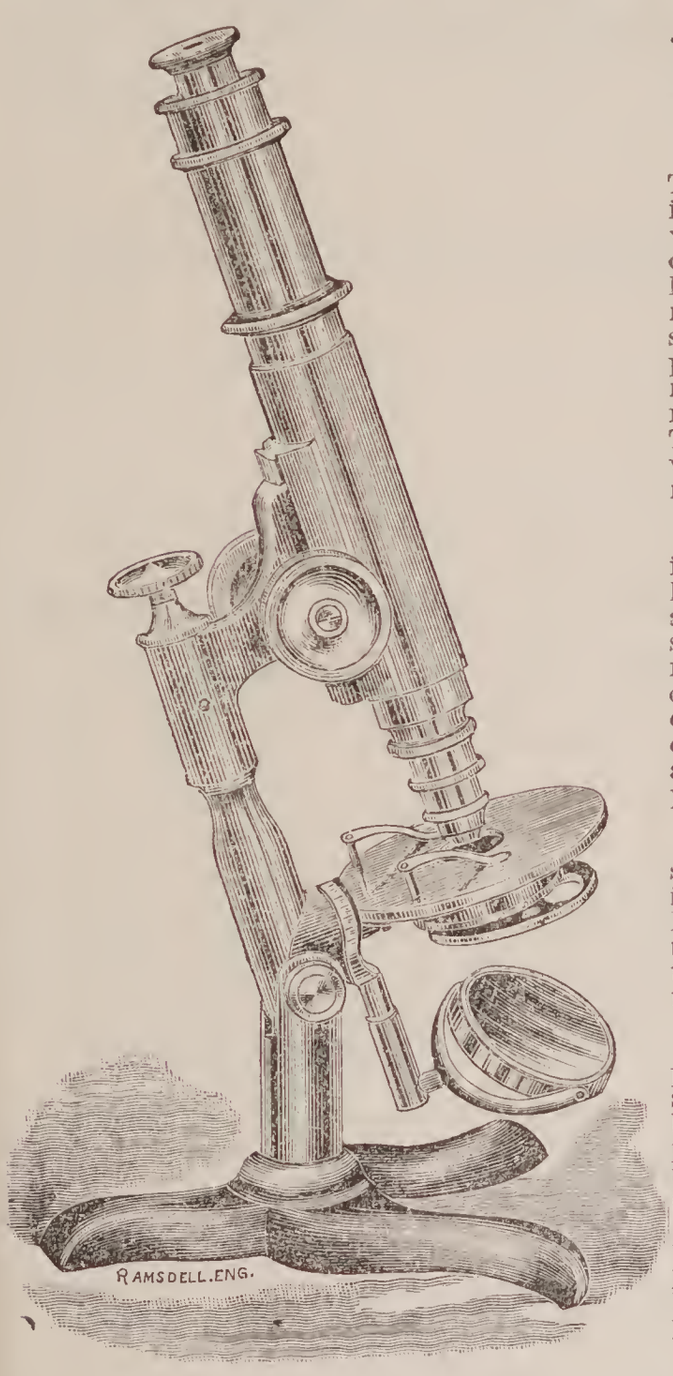

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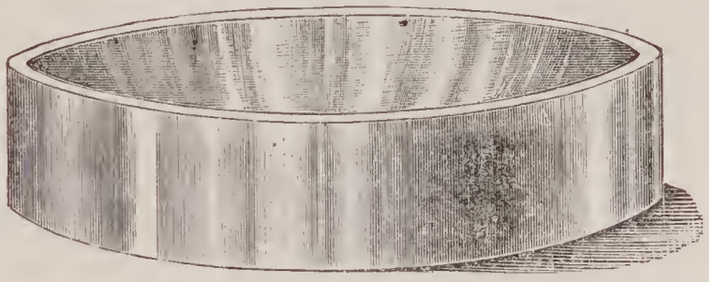

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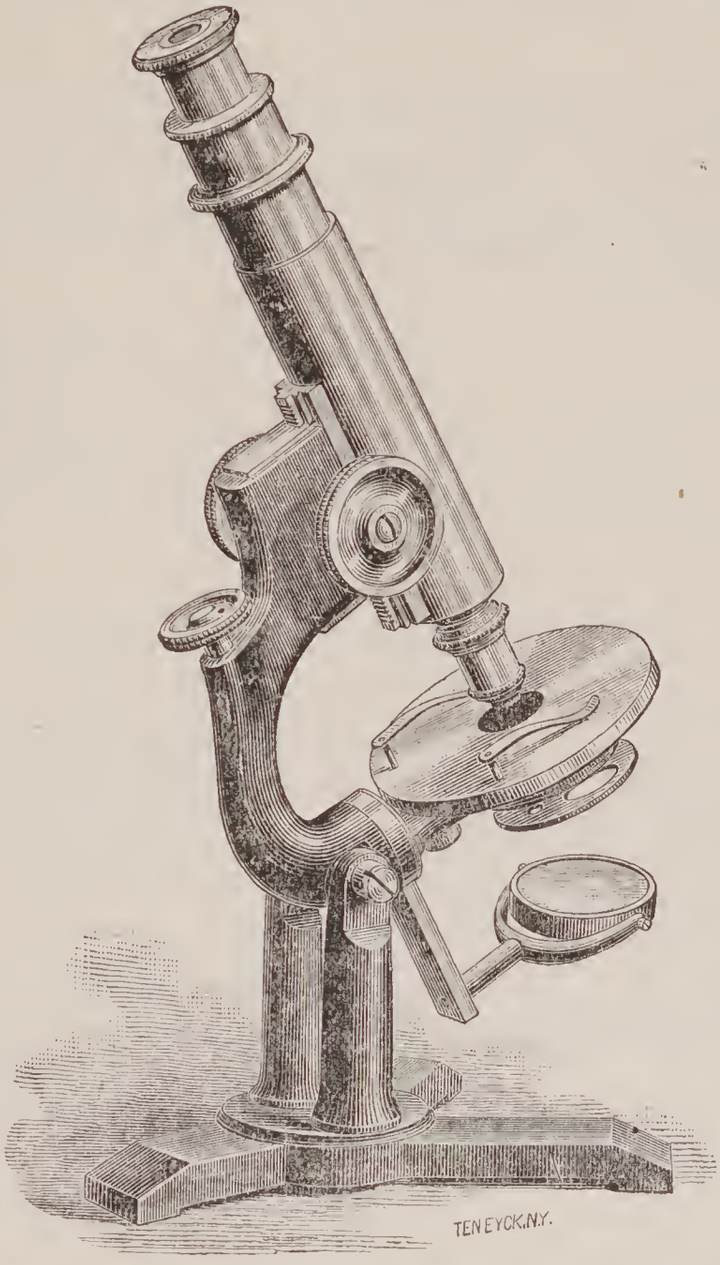

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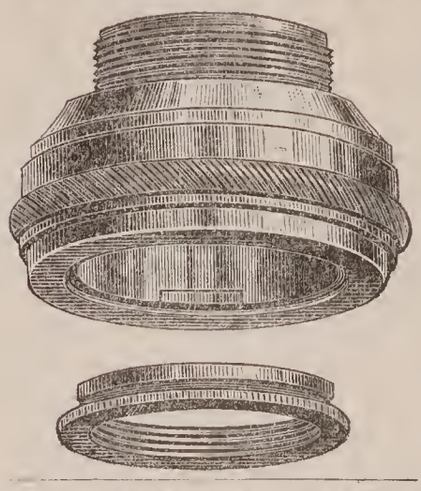

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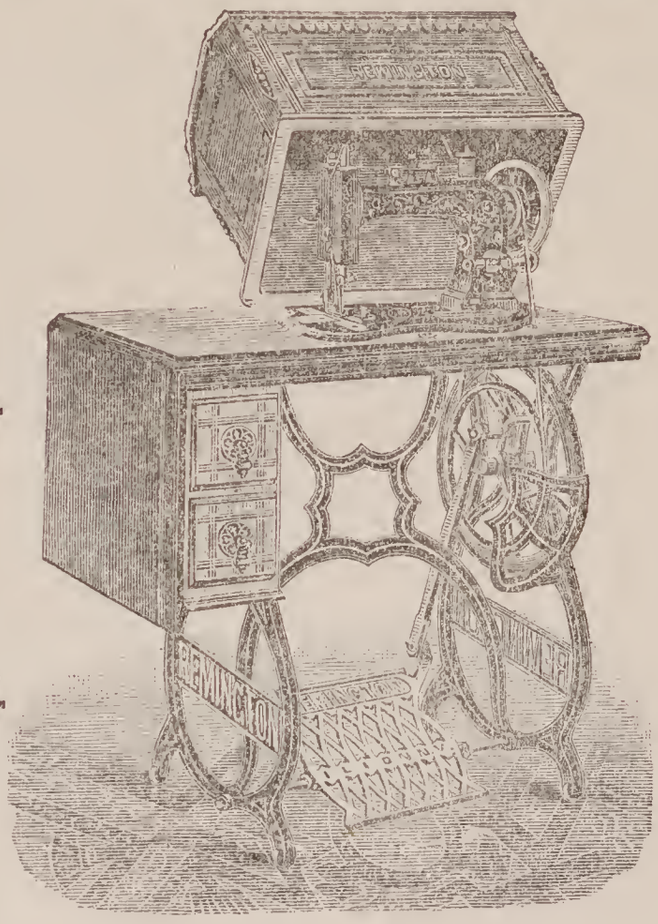

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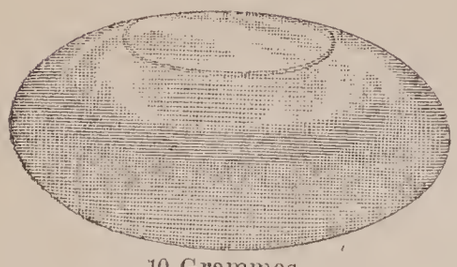

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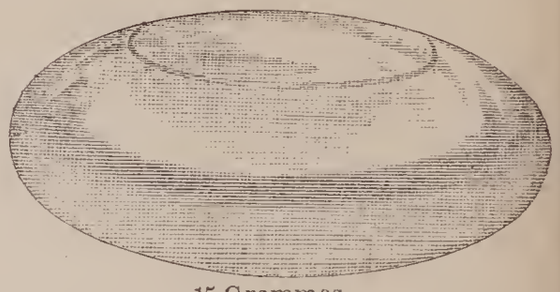

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CHAS. H. STOWELL, M. D., F. R M. S., Professor of Microscopy and Histology, Univ. Mich.

LOUISA REED STOWELL, M. S., F. R. M. S., Assistant in Microscopical Botany, Univ. Mich.

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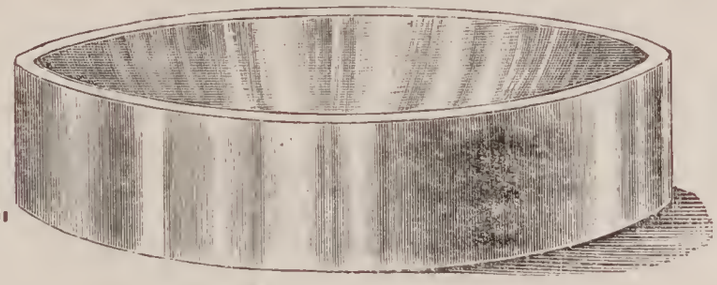

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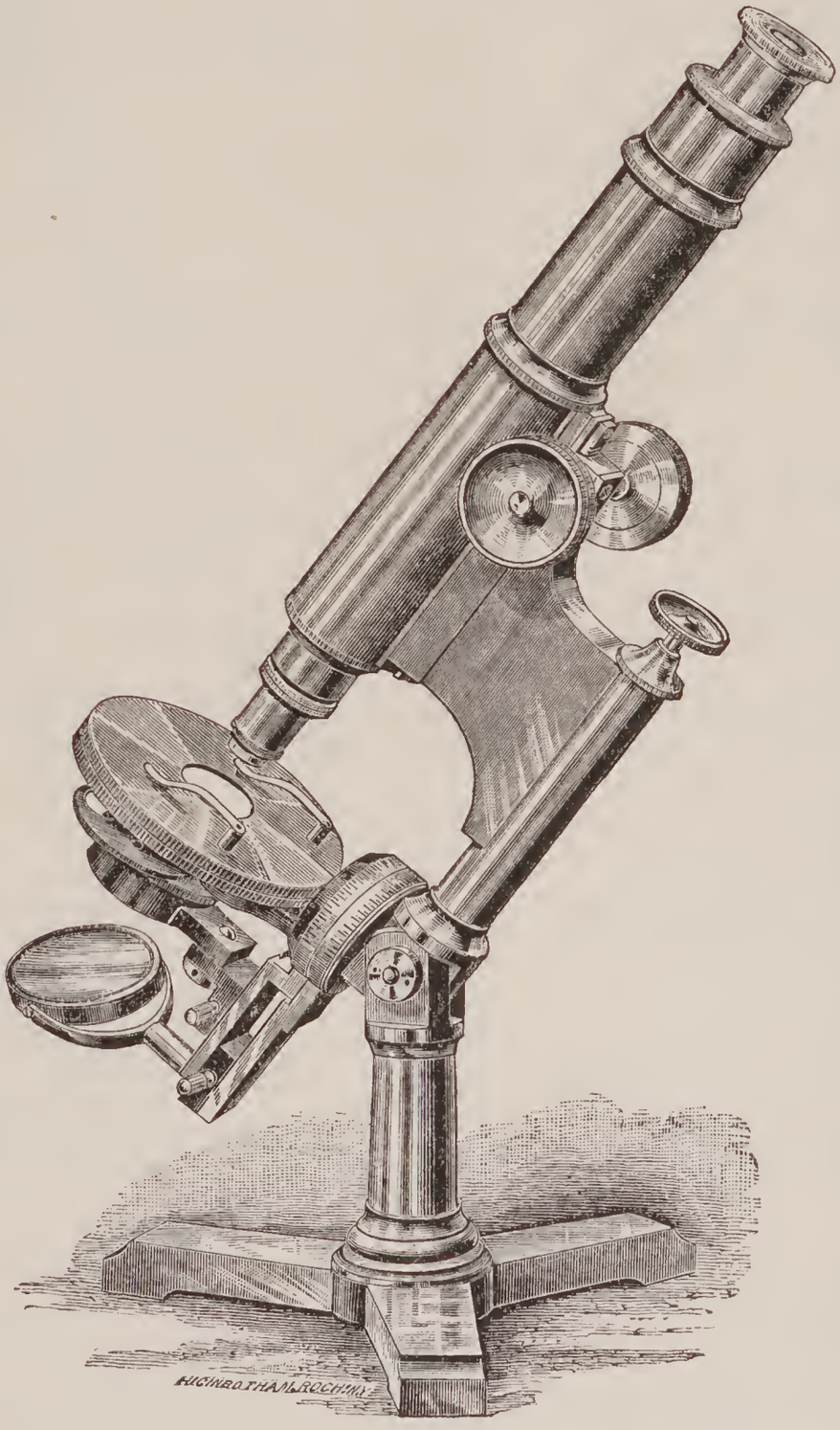

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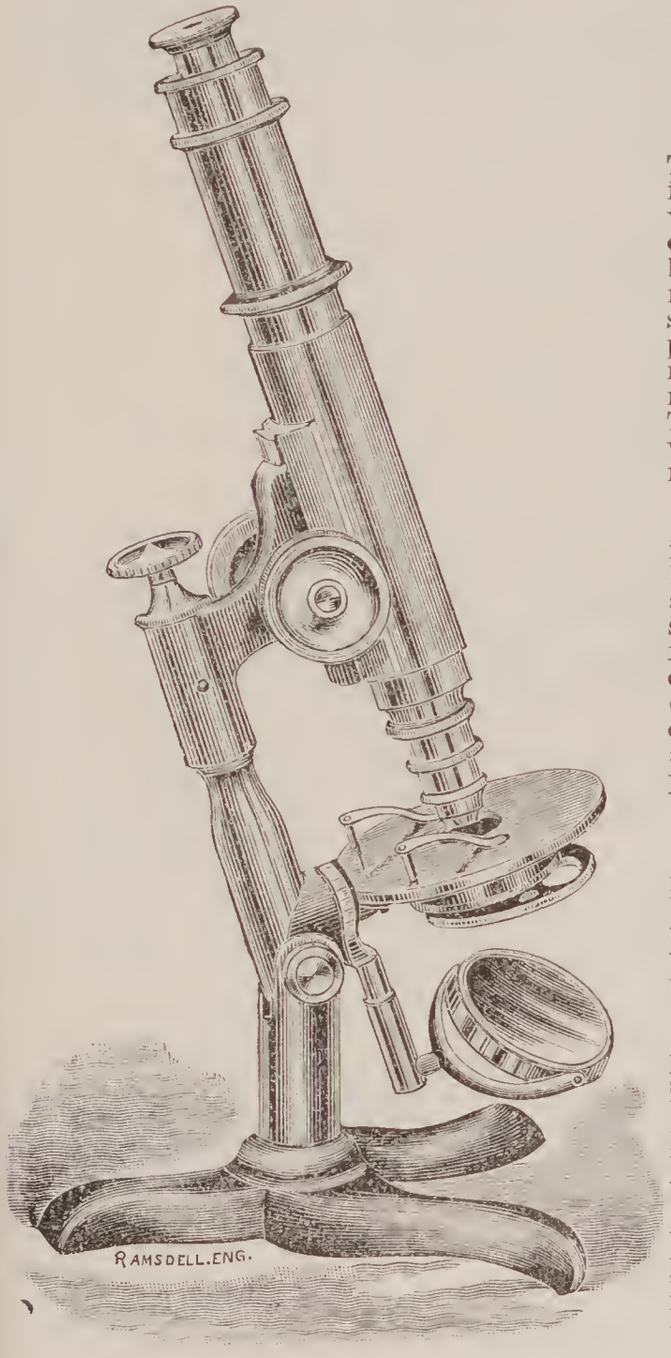

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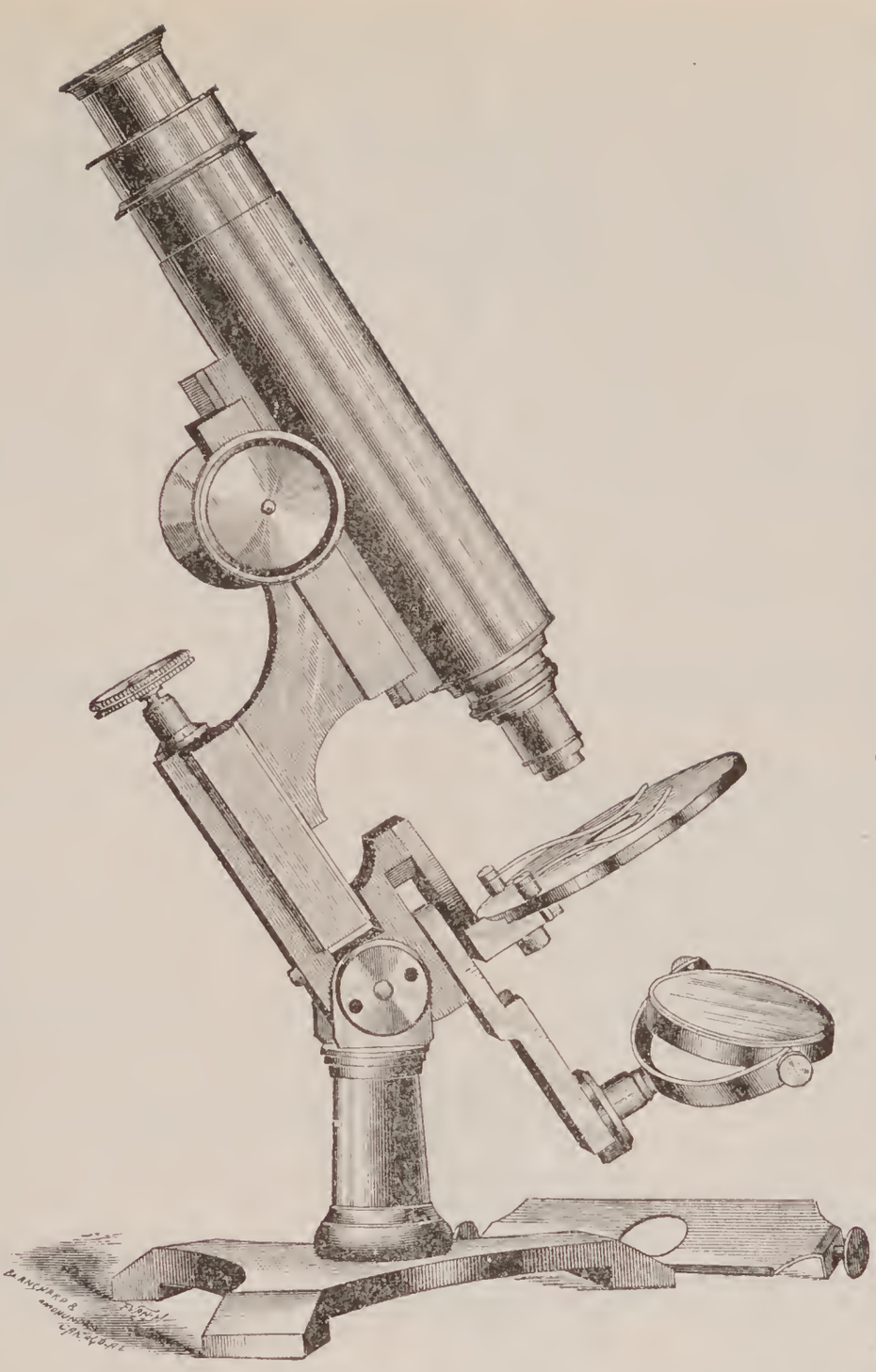

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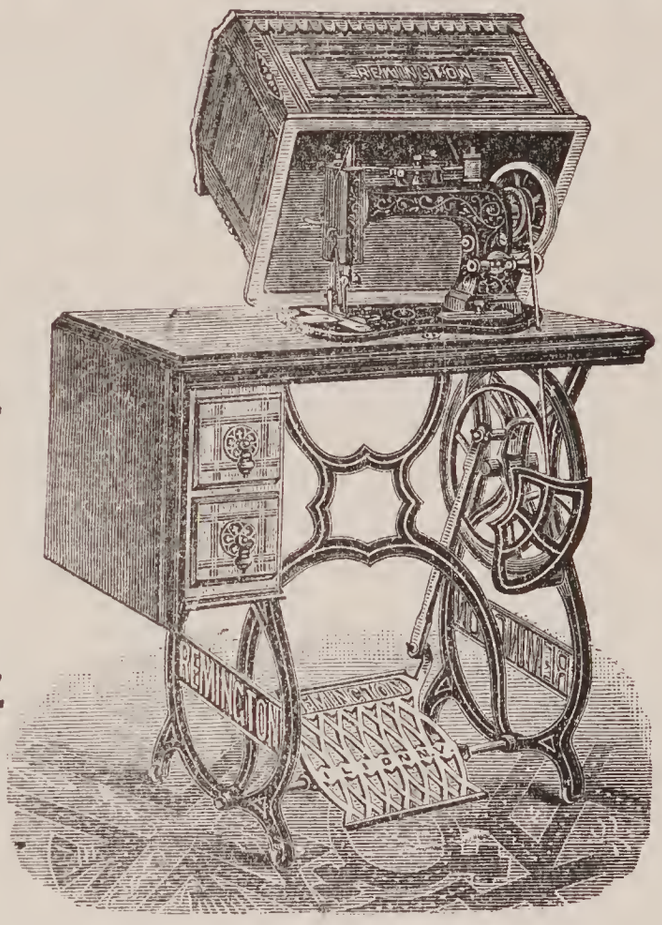

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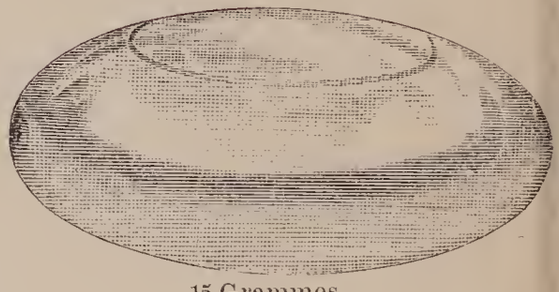

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EDITED AND PUBLISHED BY

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LOUISA REED STOWELL, M. S., F. R. M. S., Assistant in Microscopical Botany, Univ. Mich.

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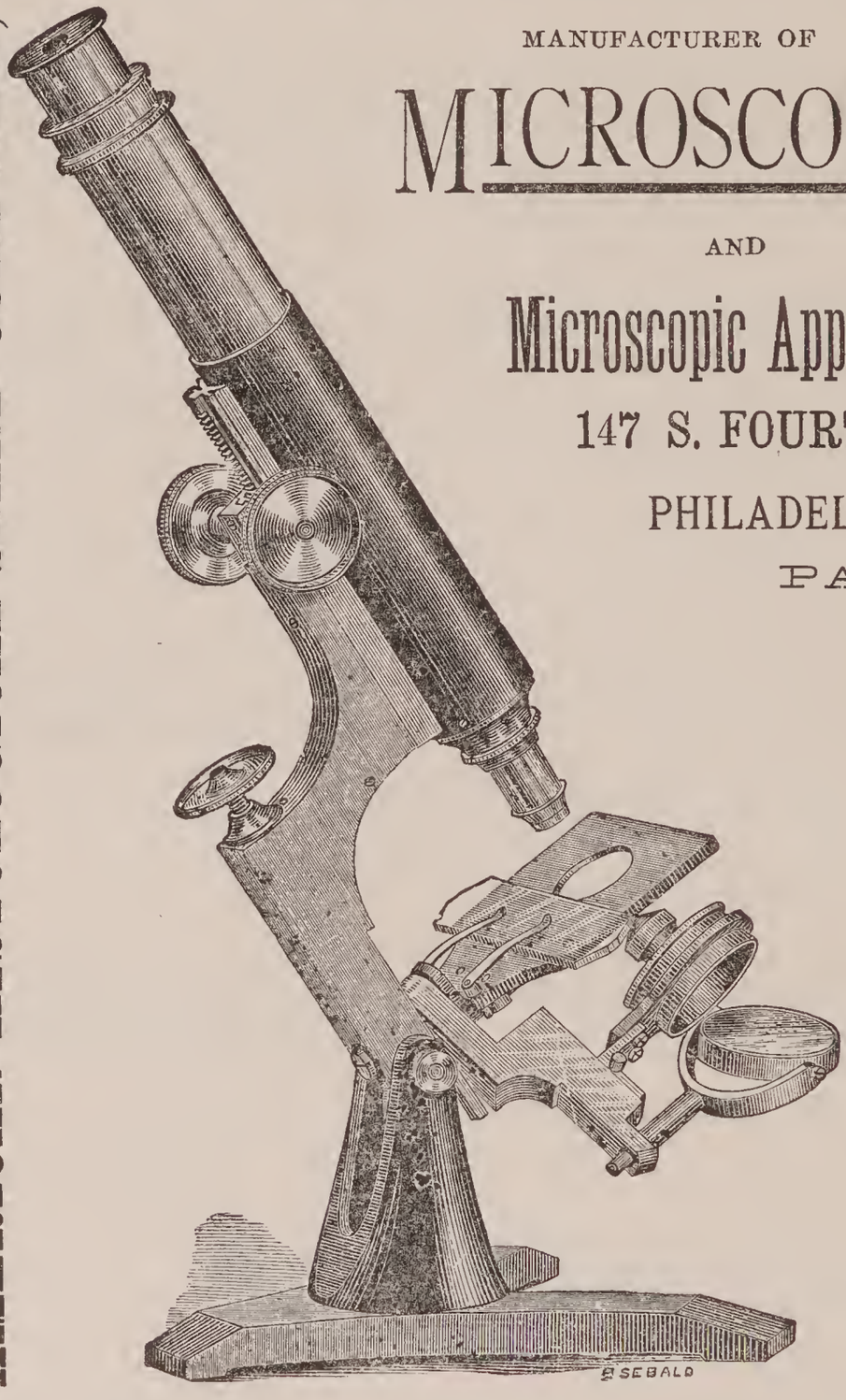

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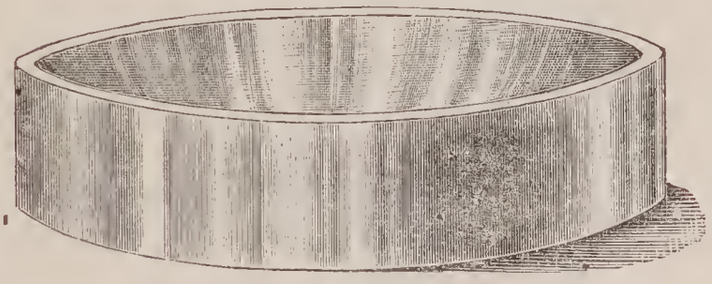

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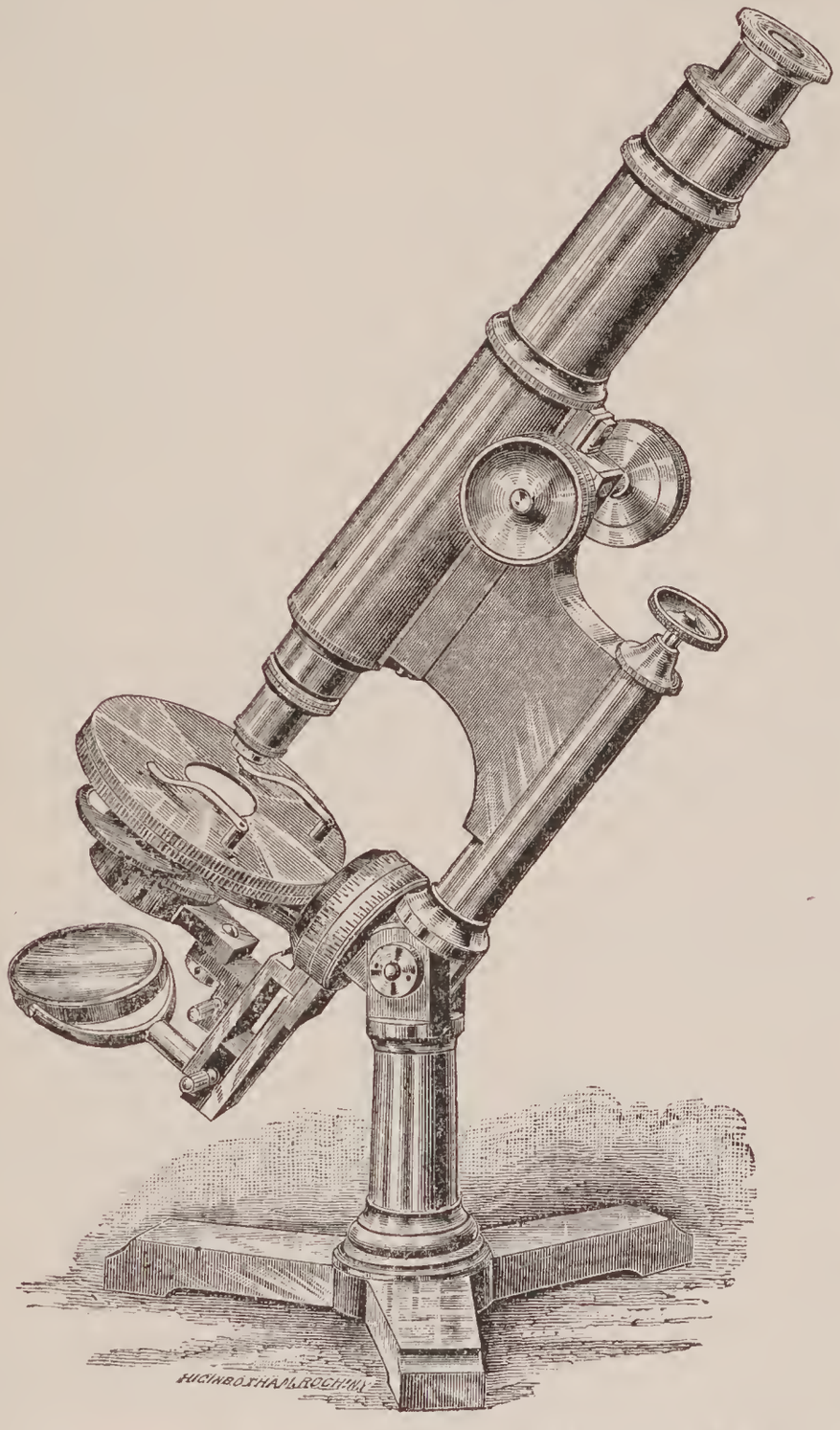

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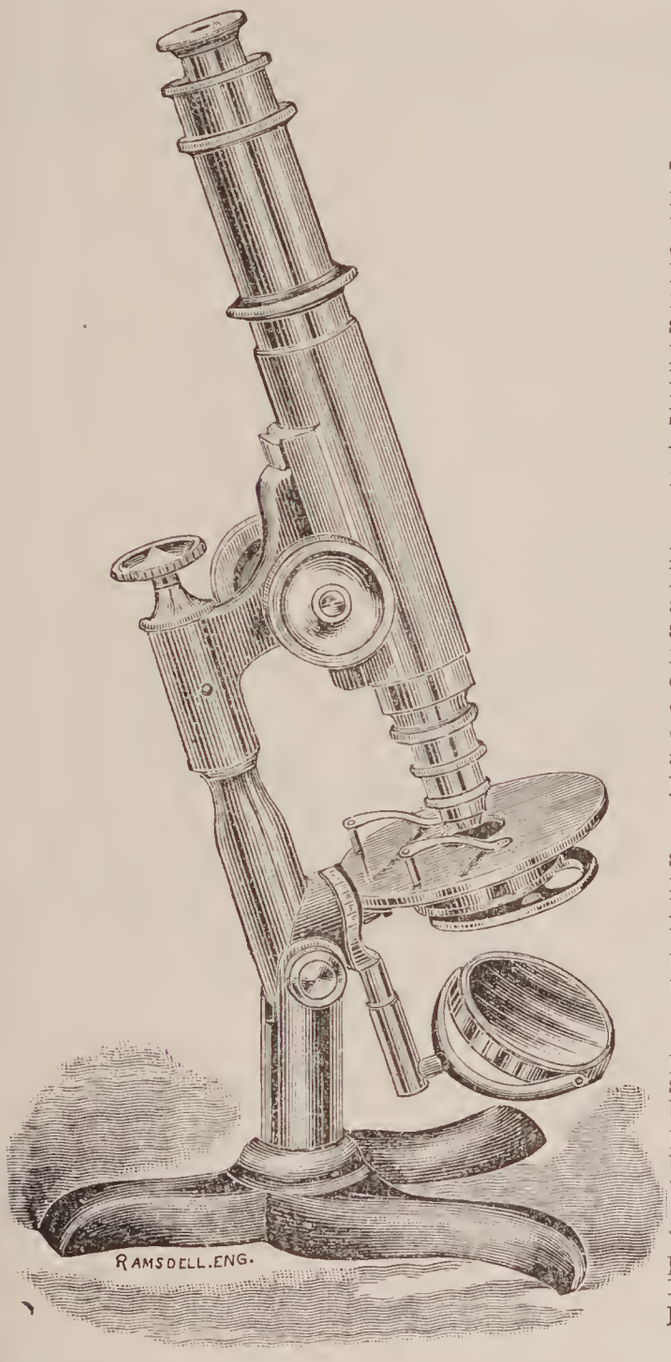

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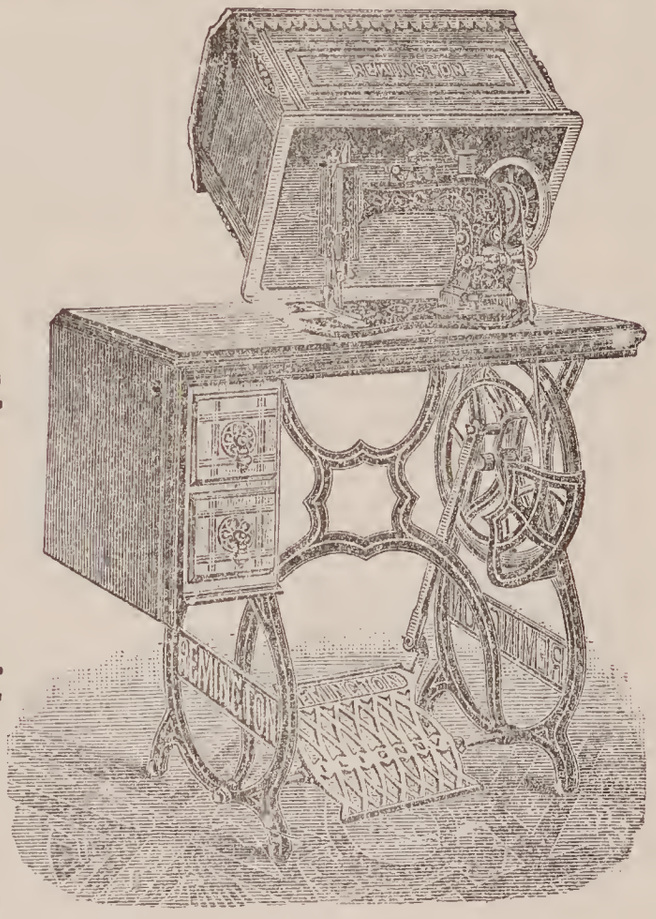

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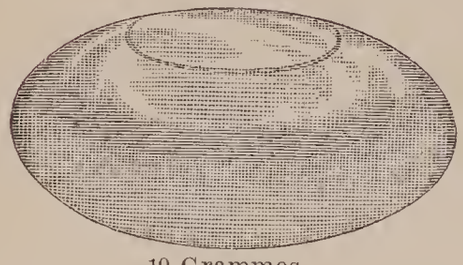

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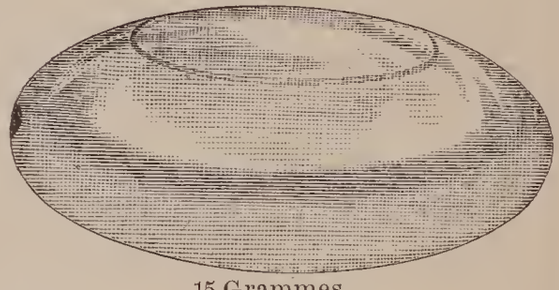

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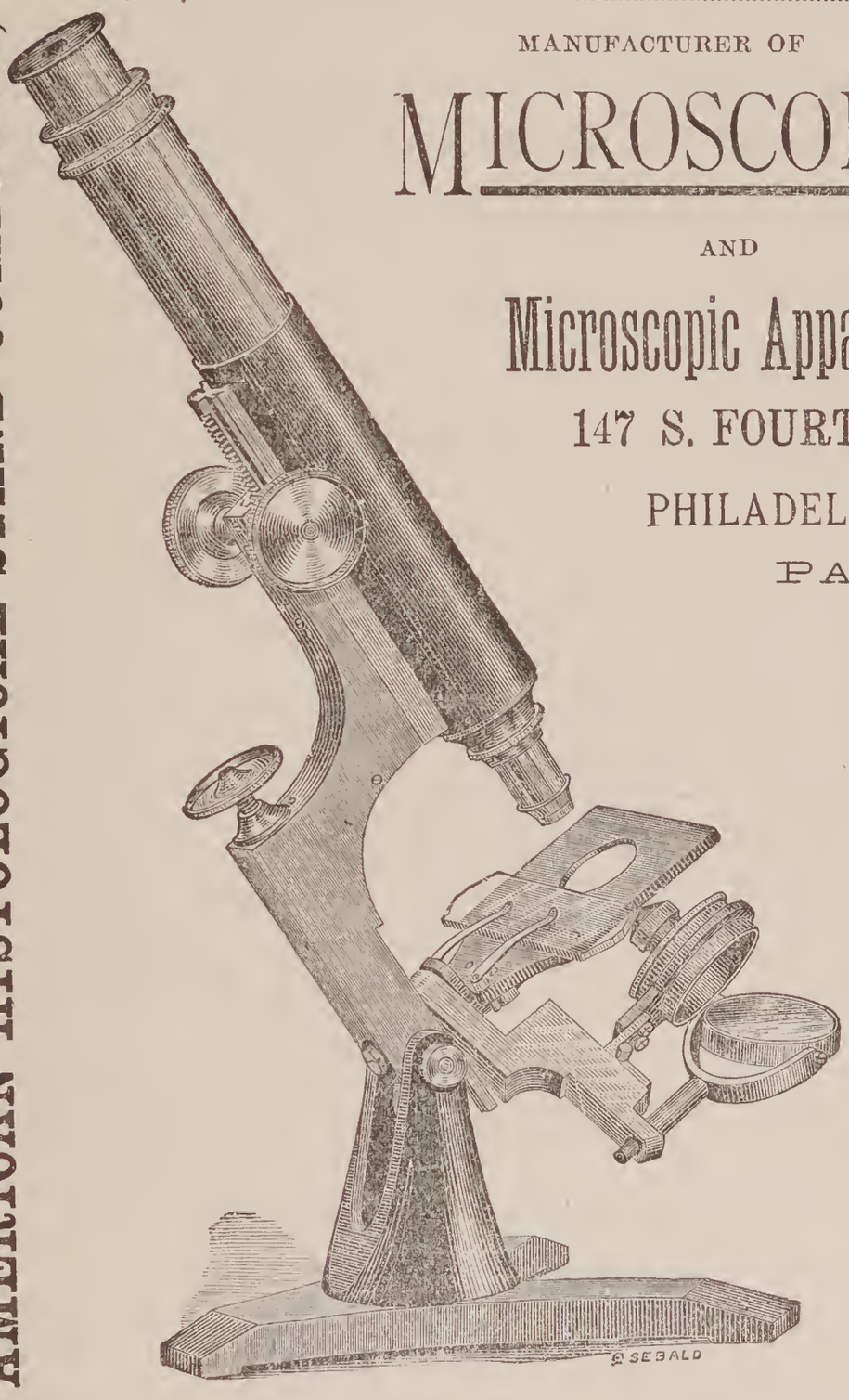

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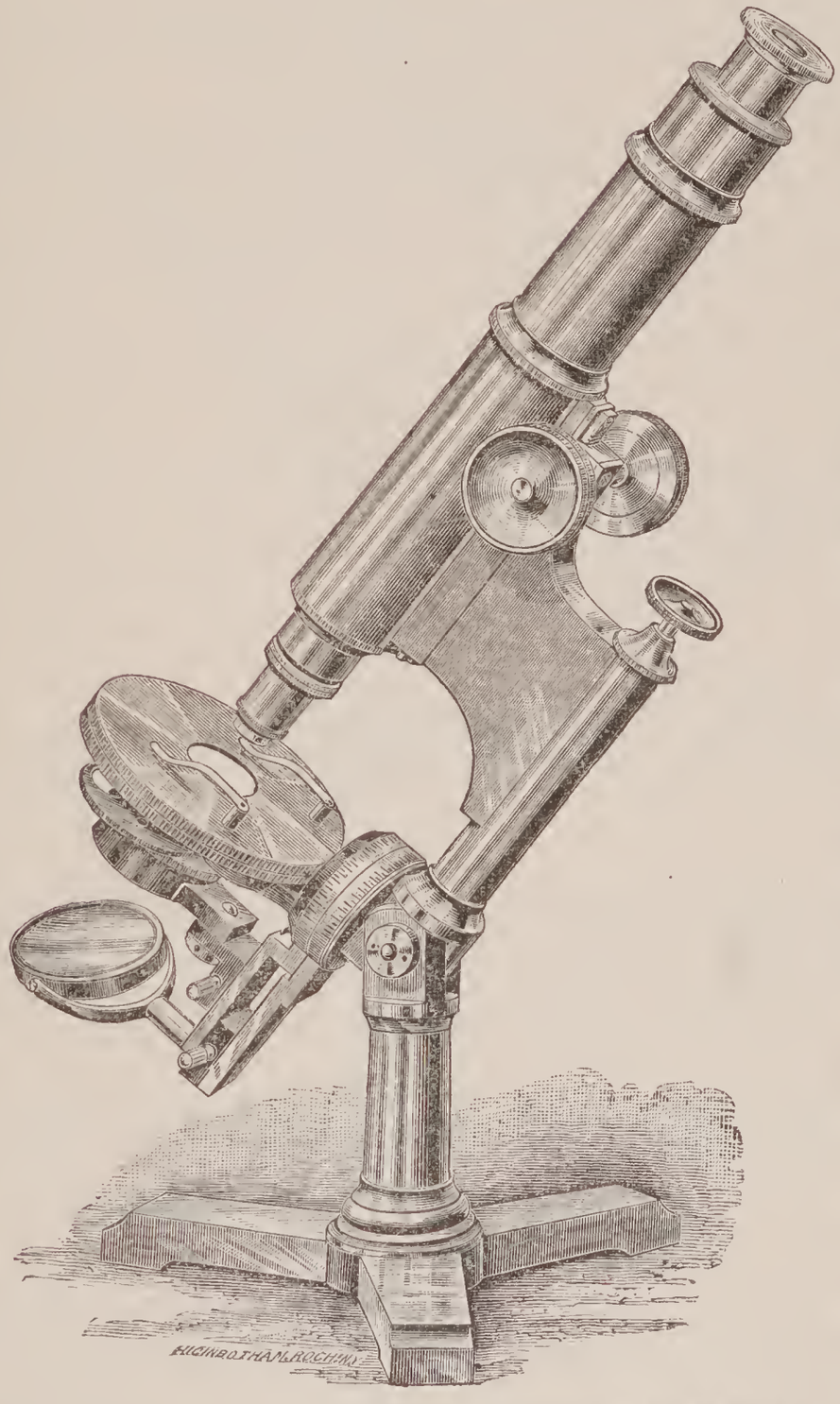

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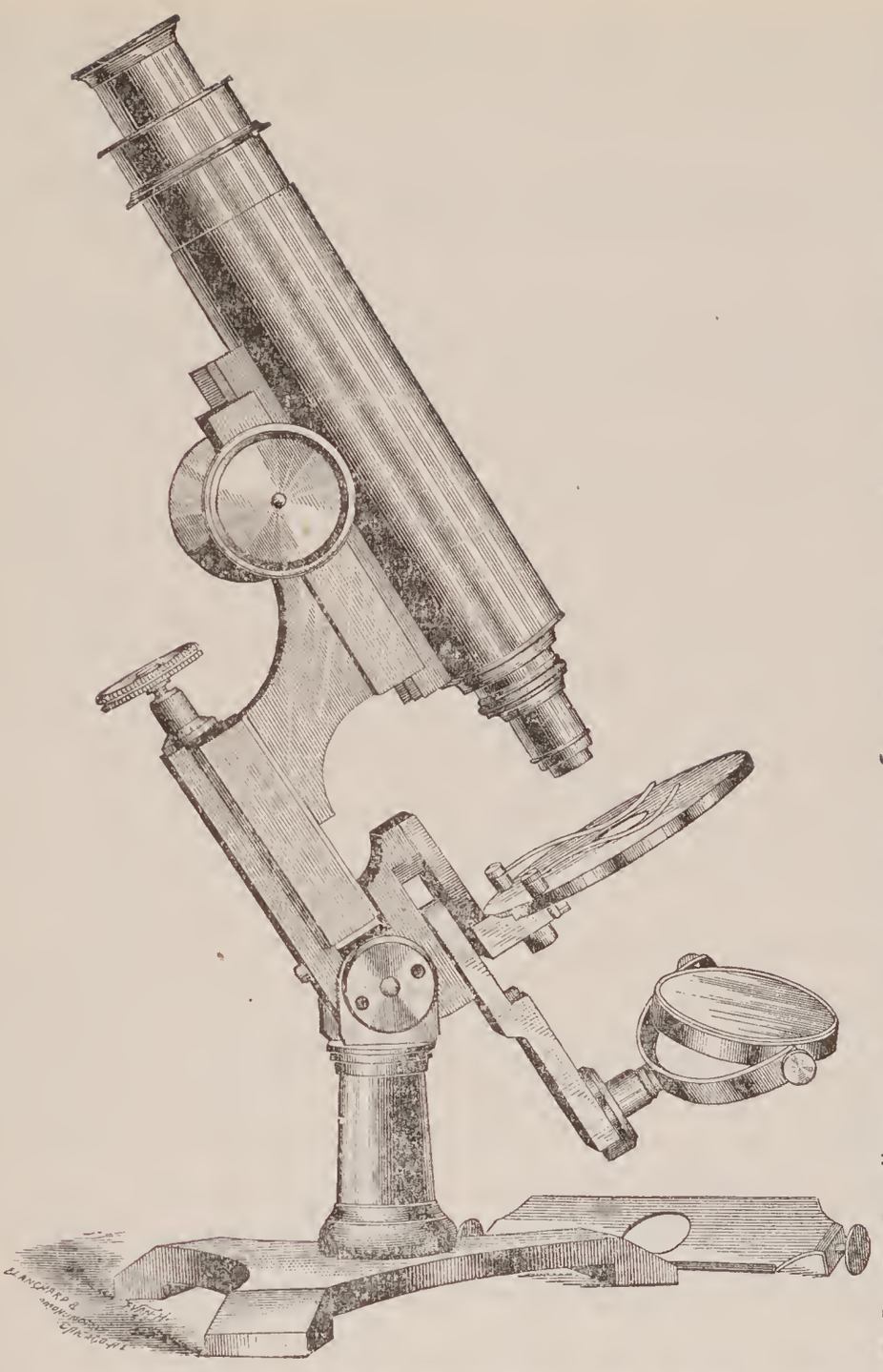

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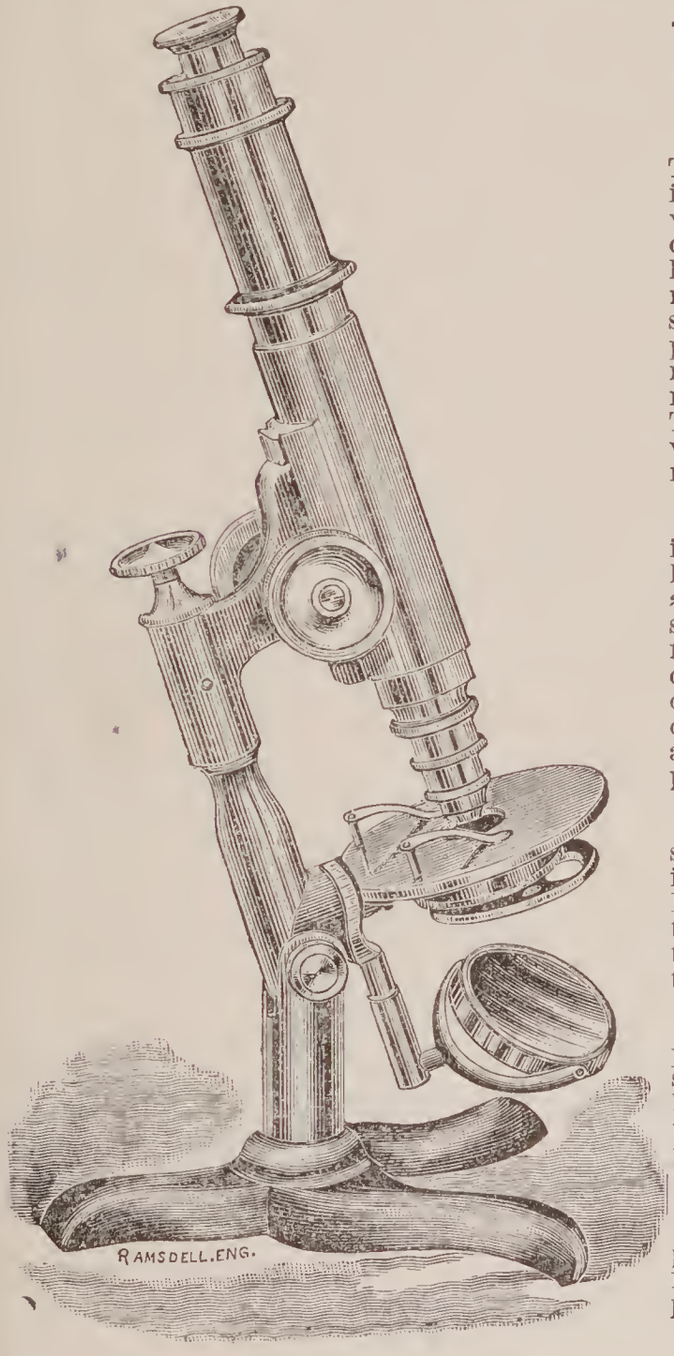

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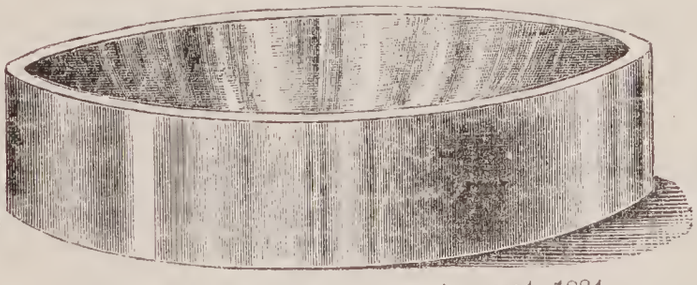

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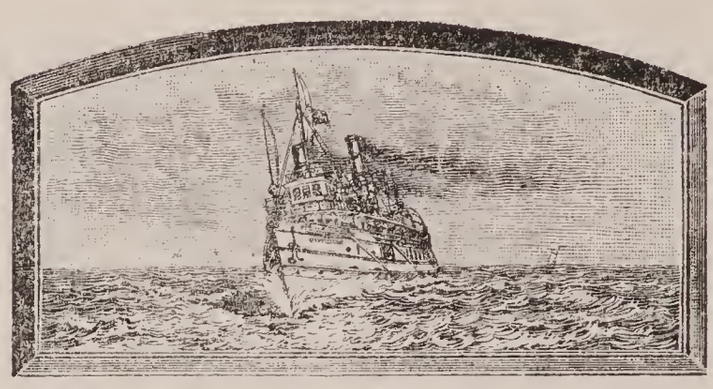

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No. 6.

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EDITED AND PUBLISHED BY

CHAS. H. STOWELL, M. D., F. R. M. S.,
Professor of Microscopy and Histology, Univ. Mich.

LOUISA REED STOWELL, M. S., F. R. M. S.,
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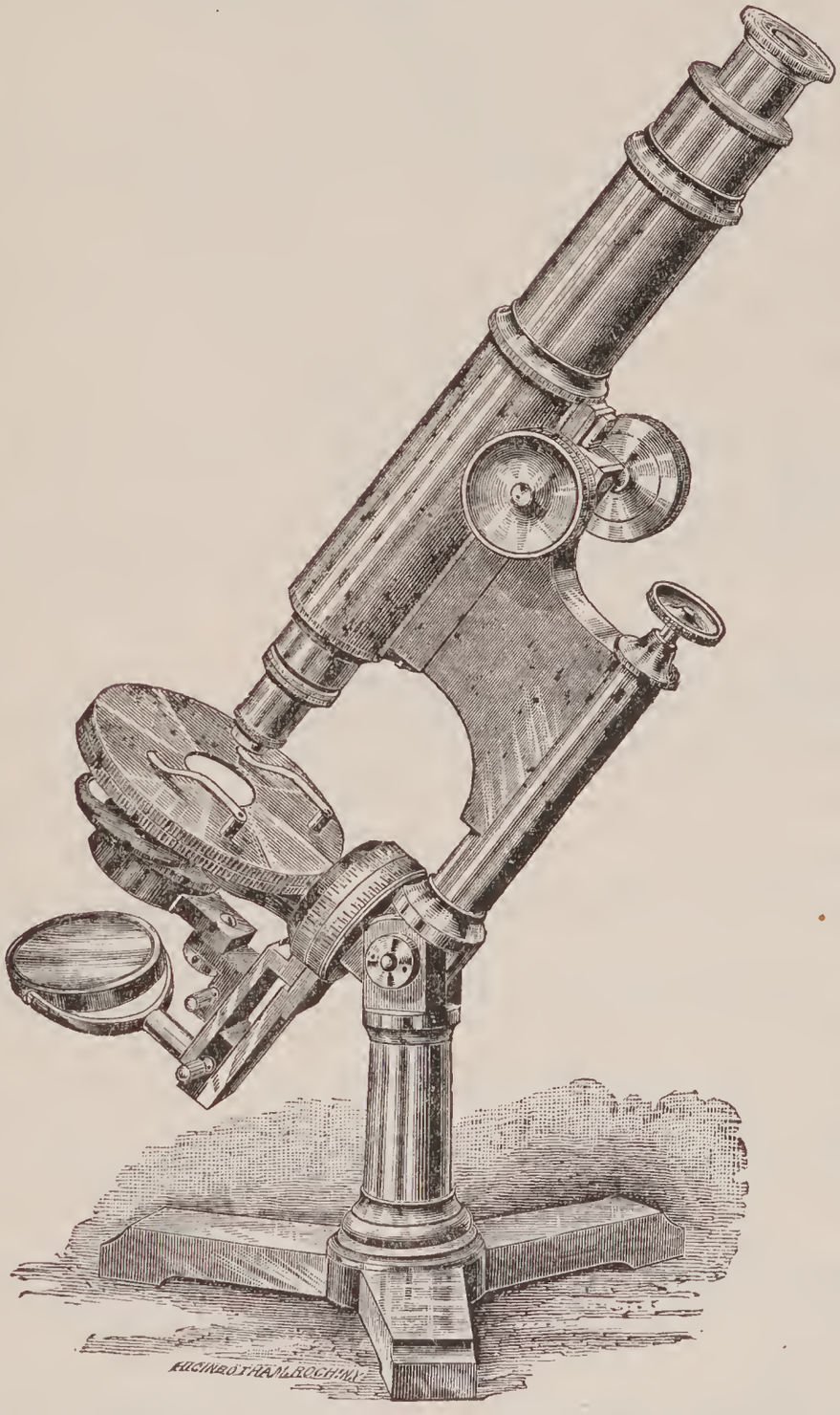

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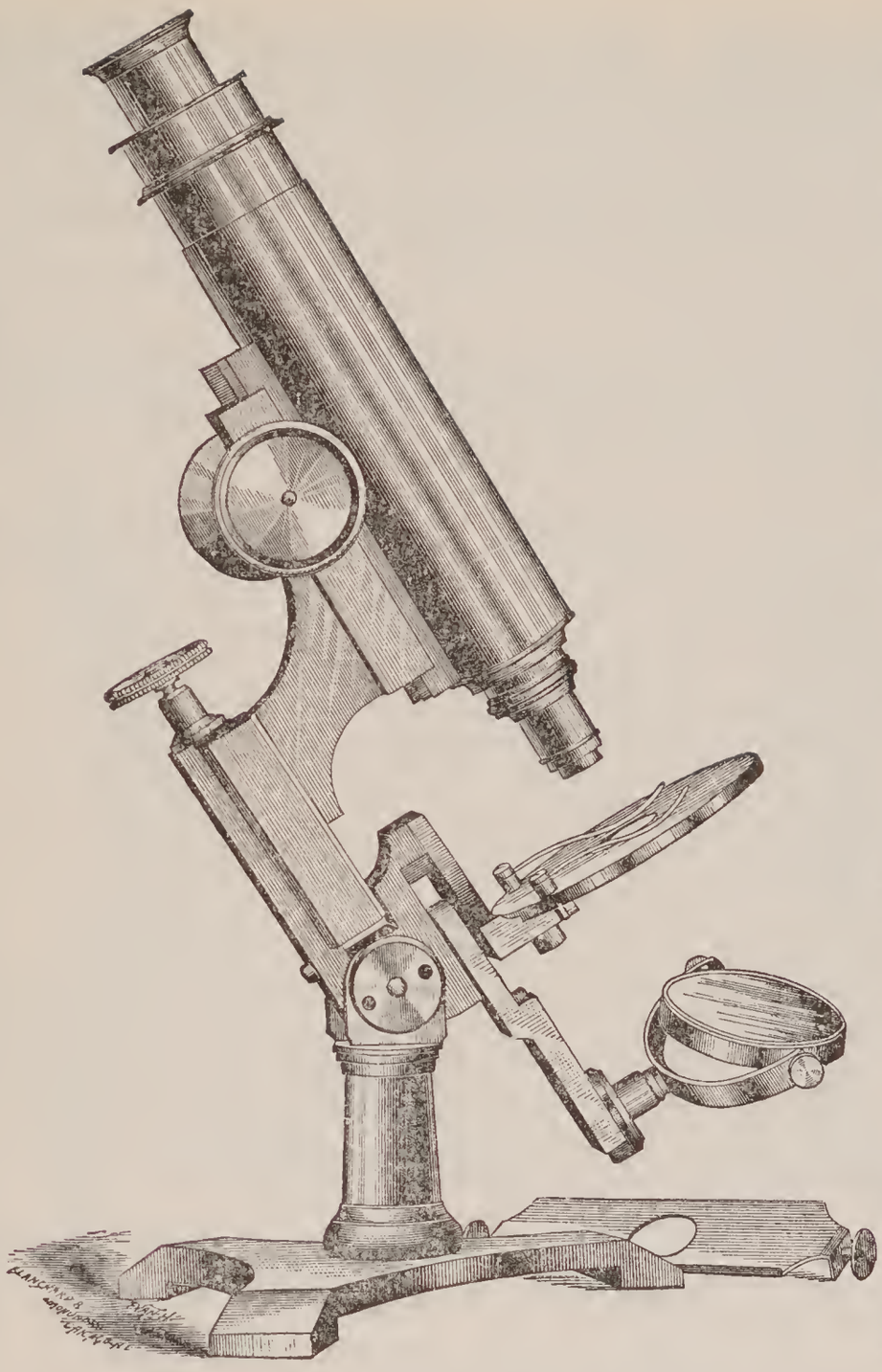

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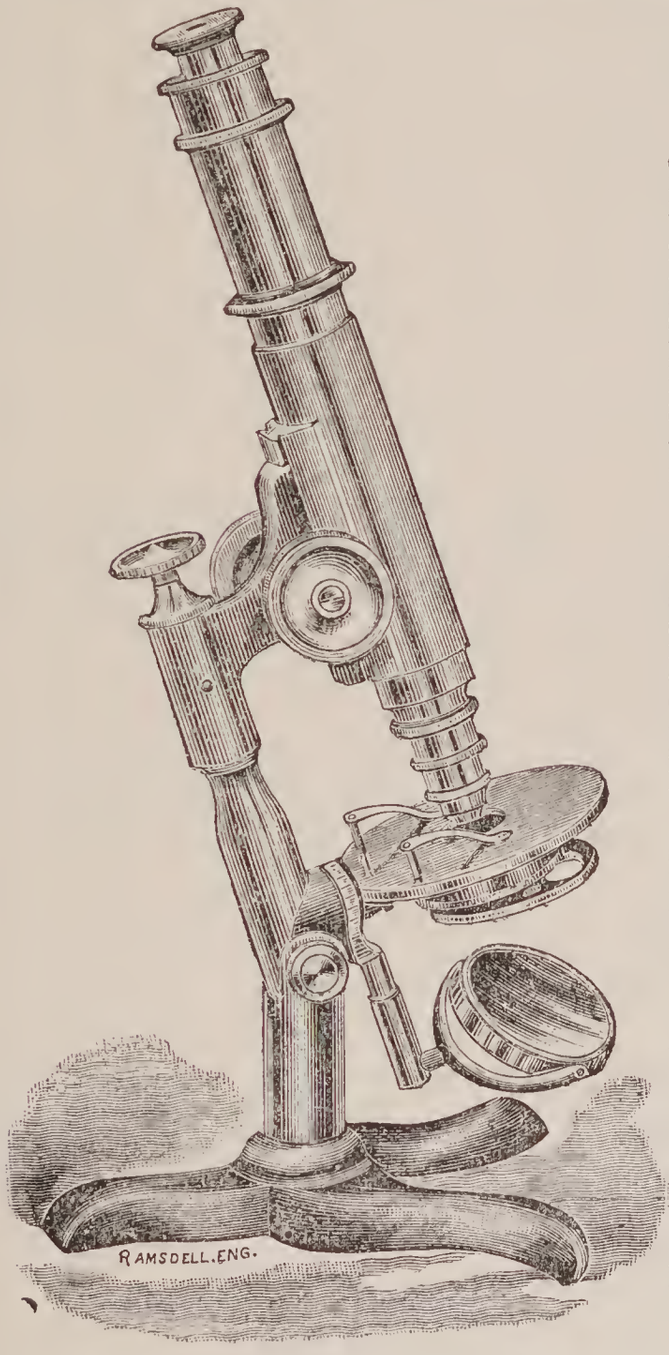

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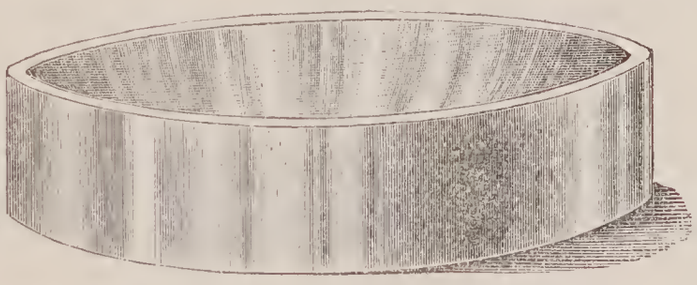

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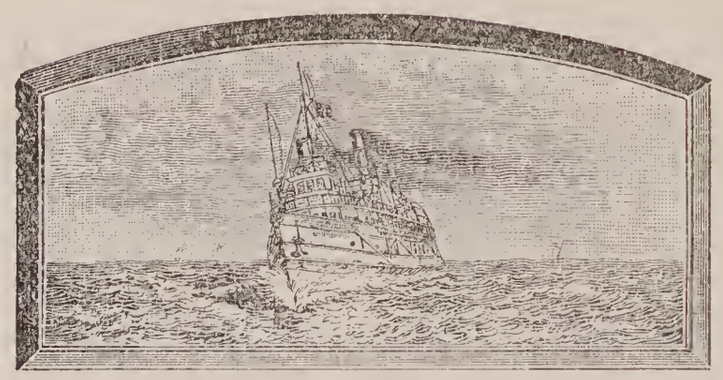

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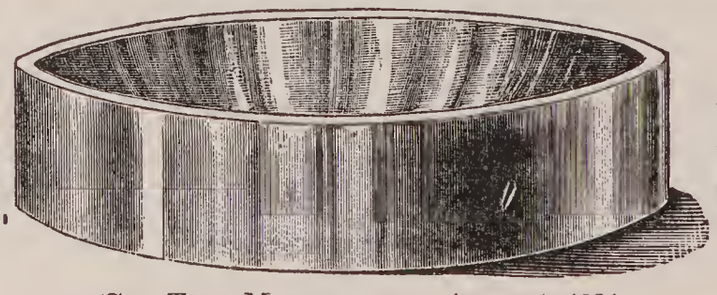

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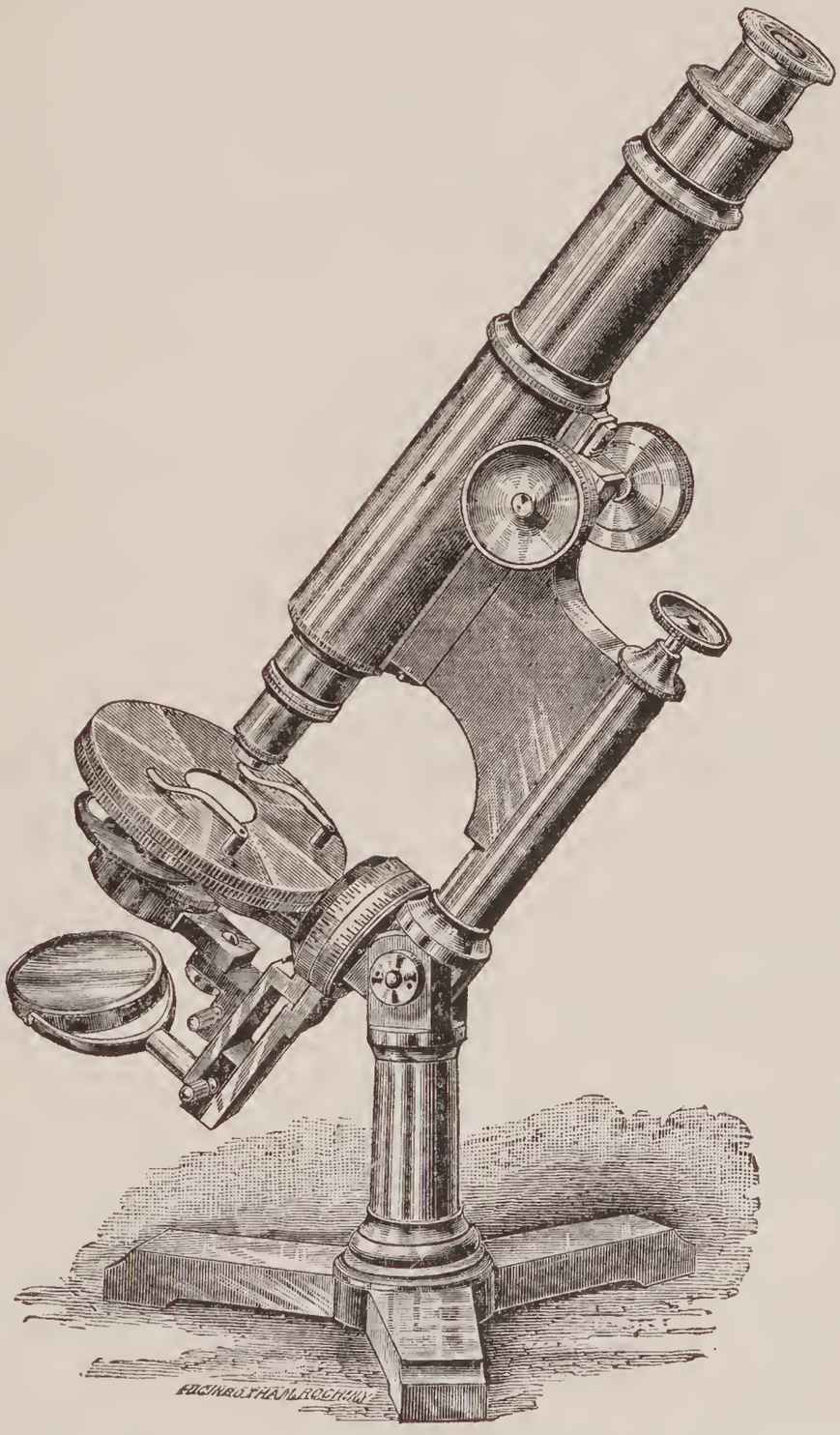

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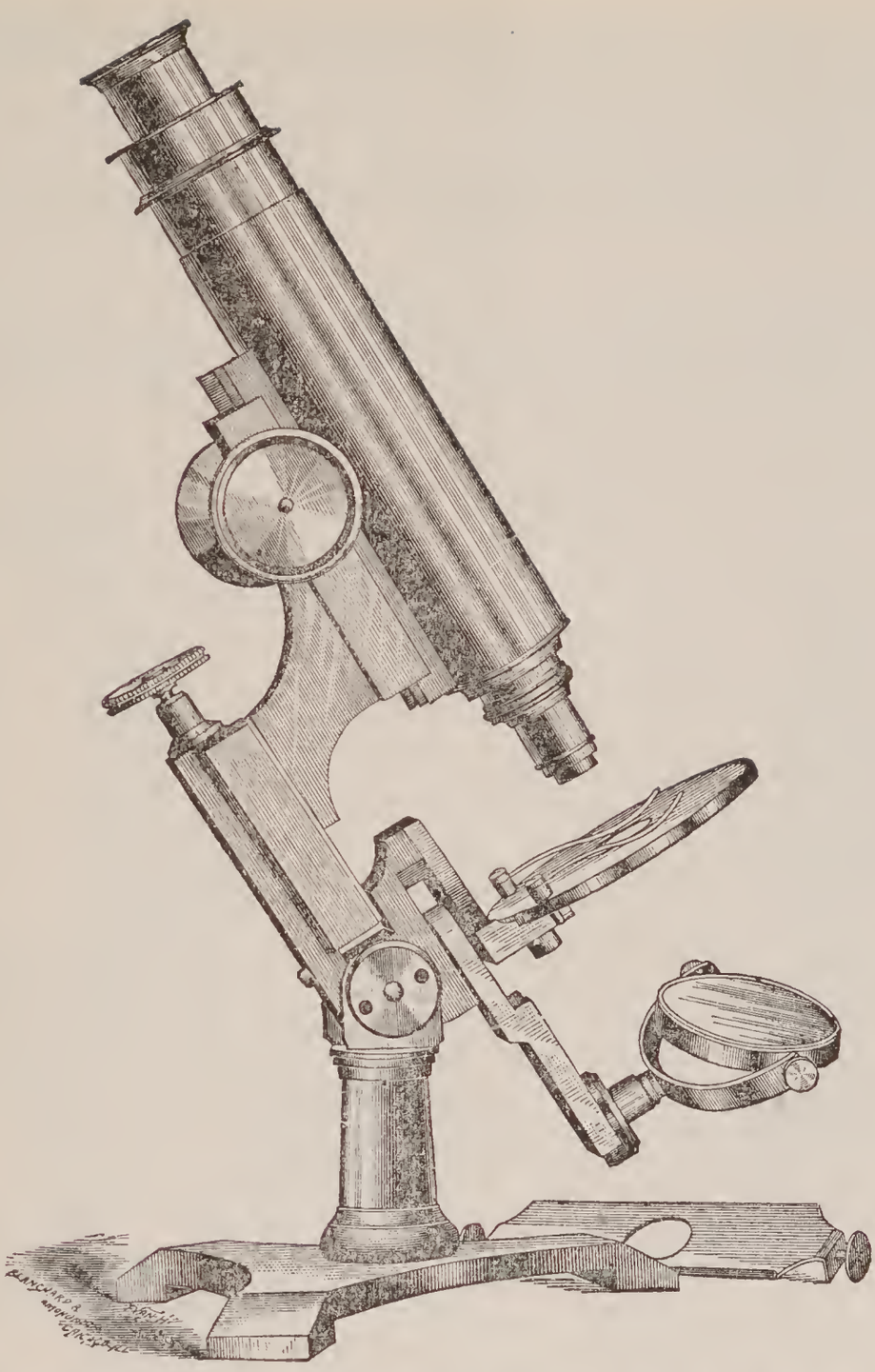

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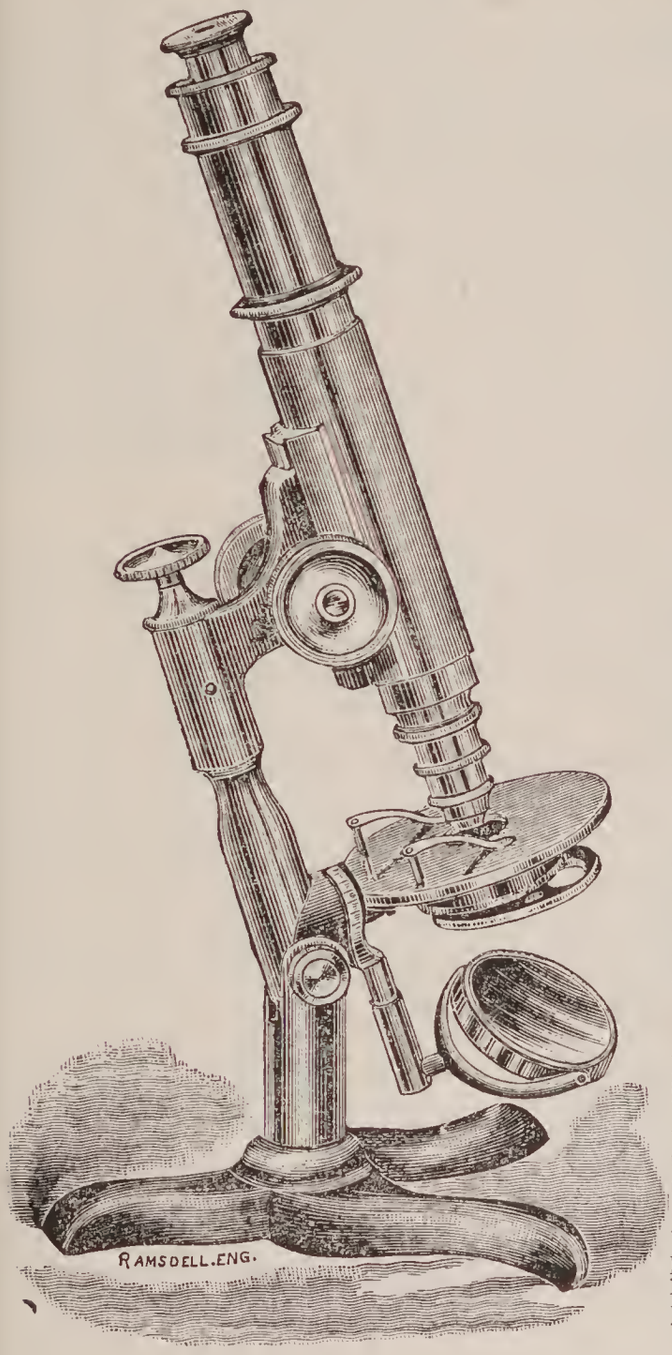

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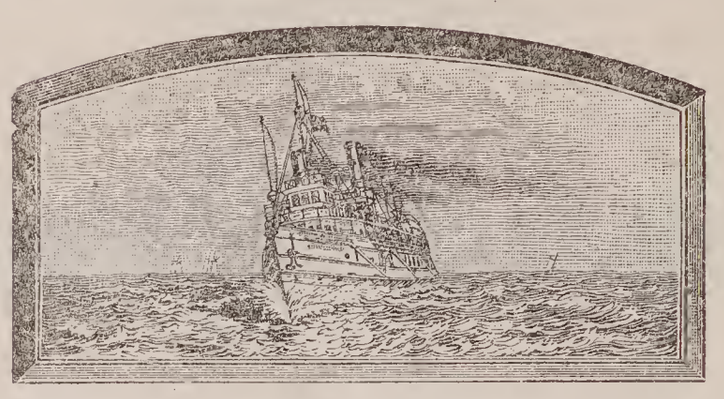

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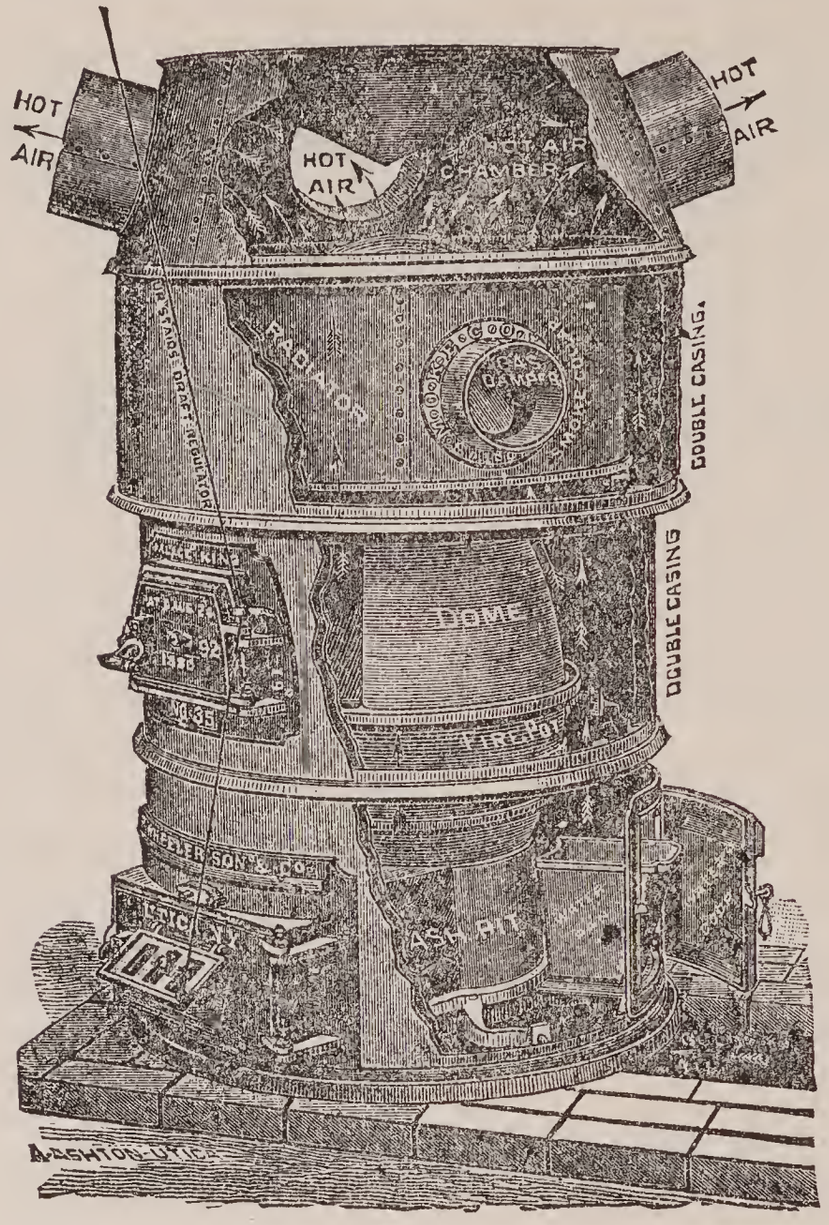

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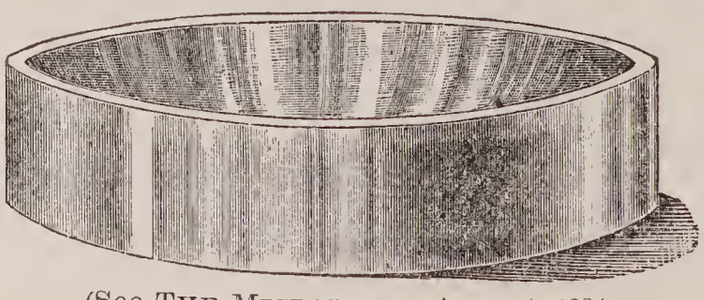

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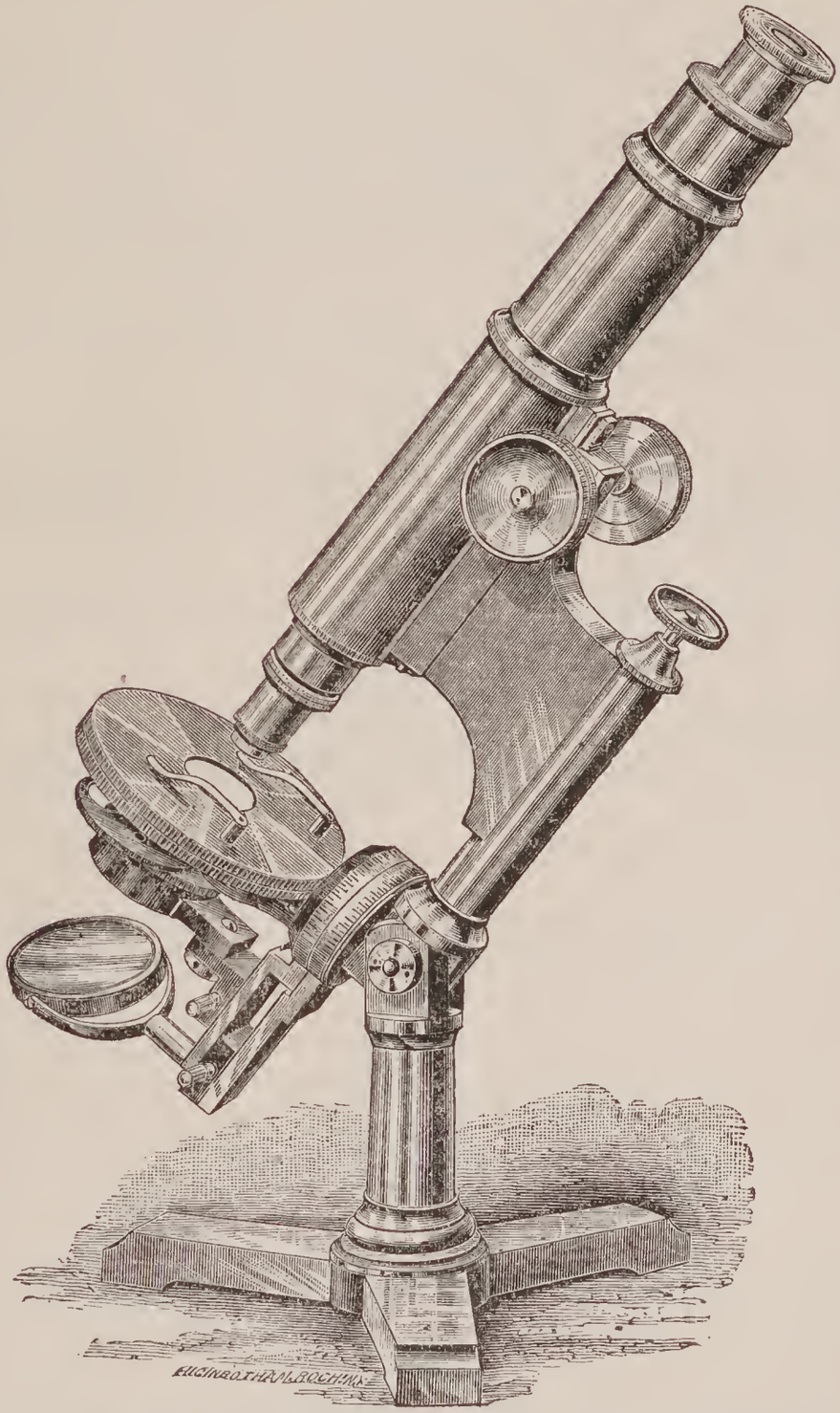

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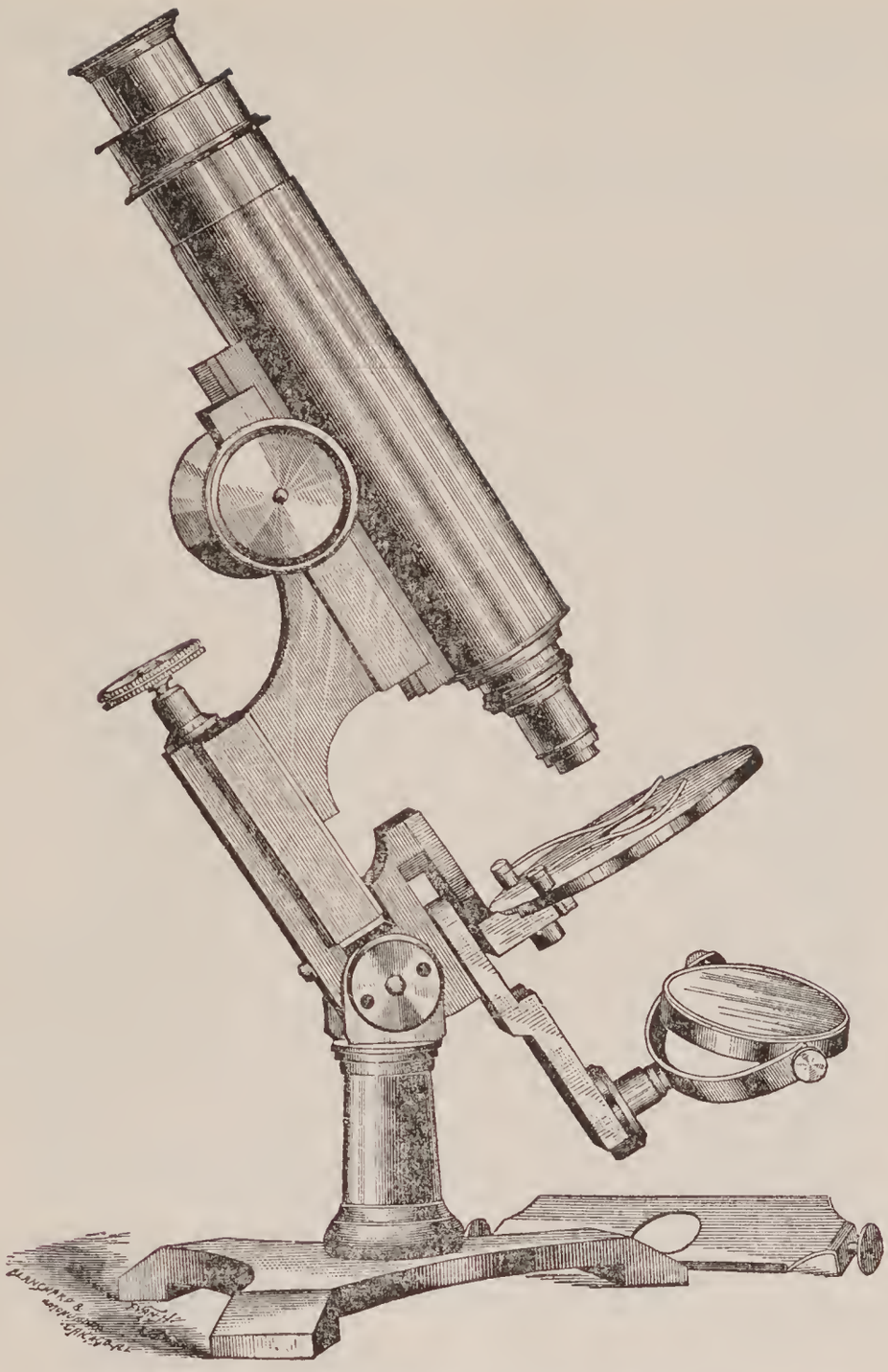

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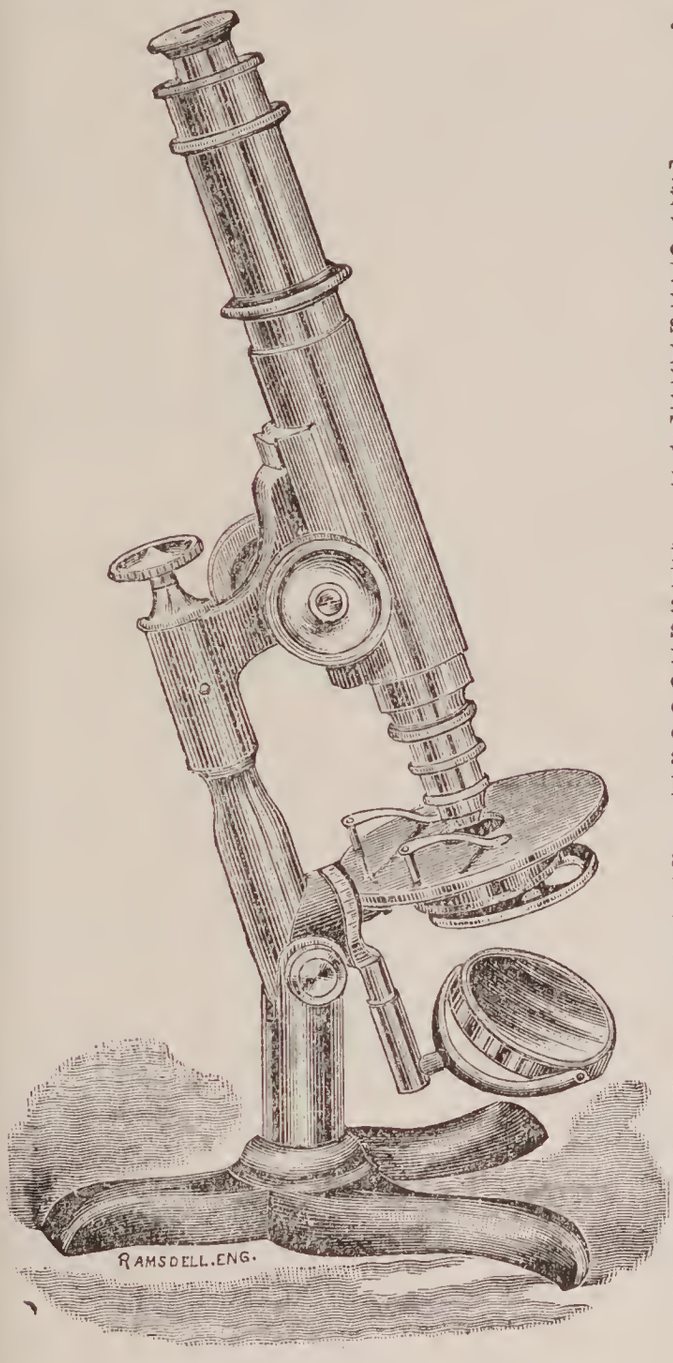

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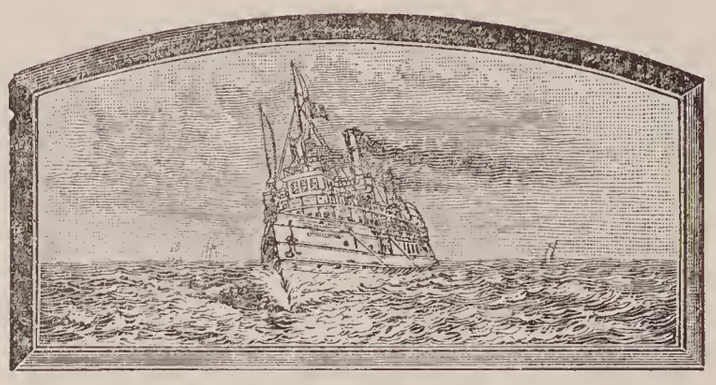

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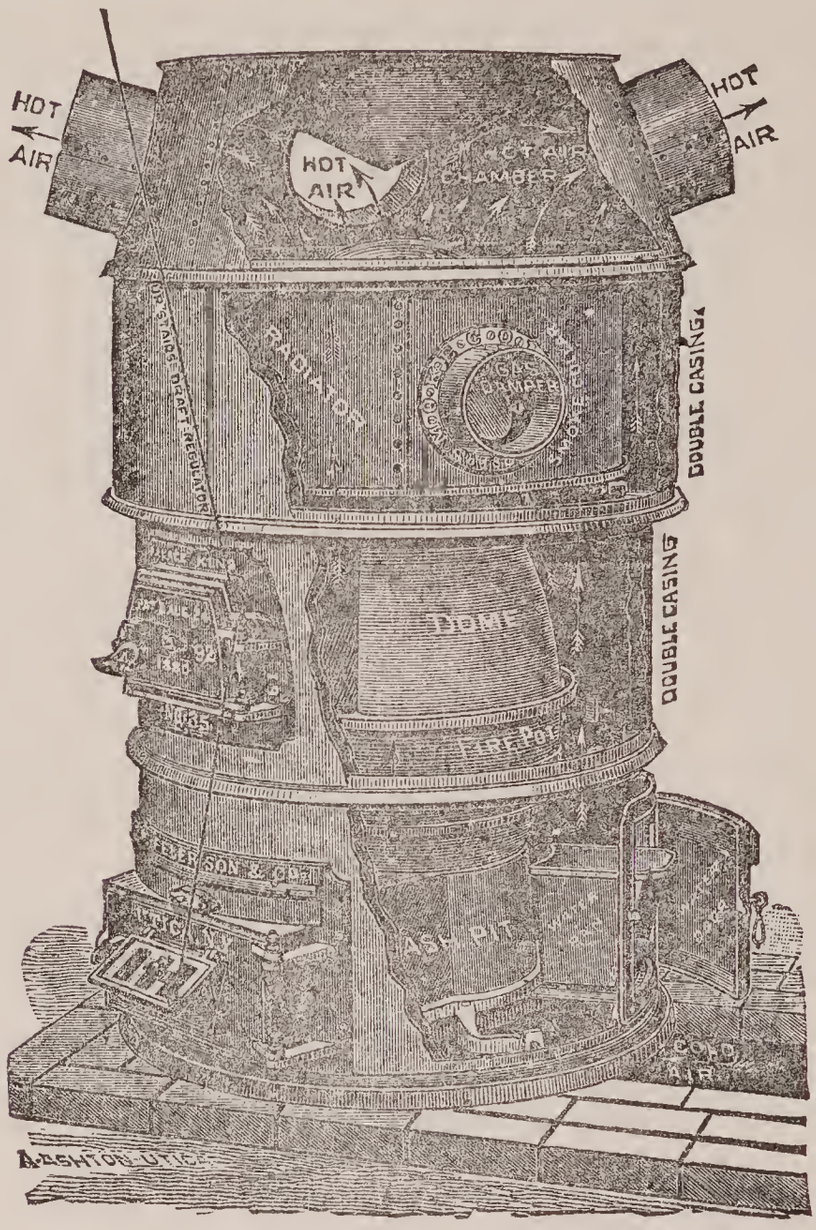

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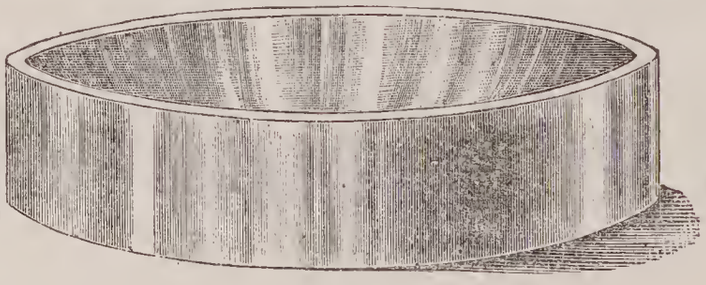

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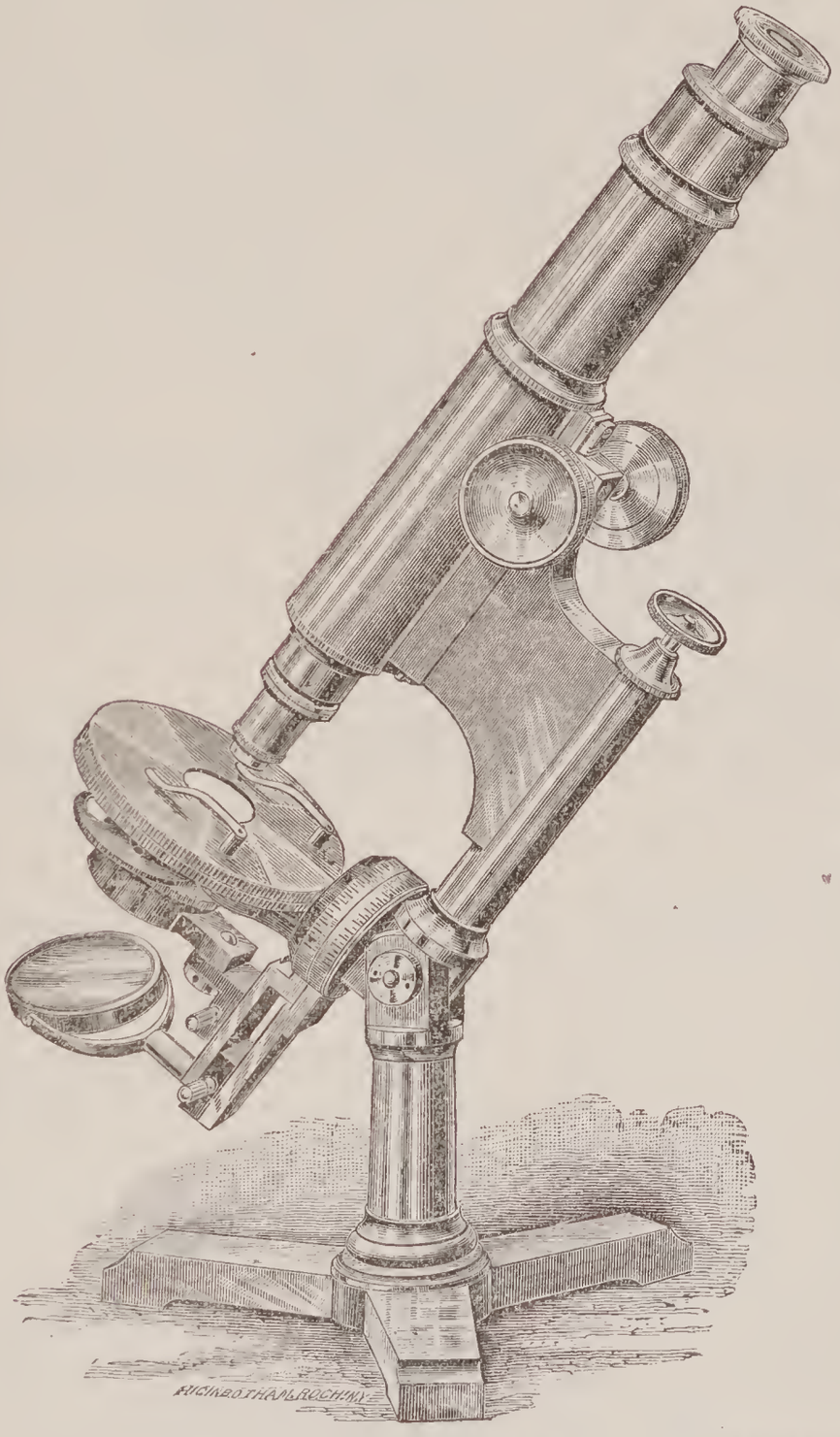

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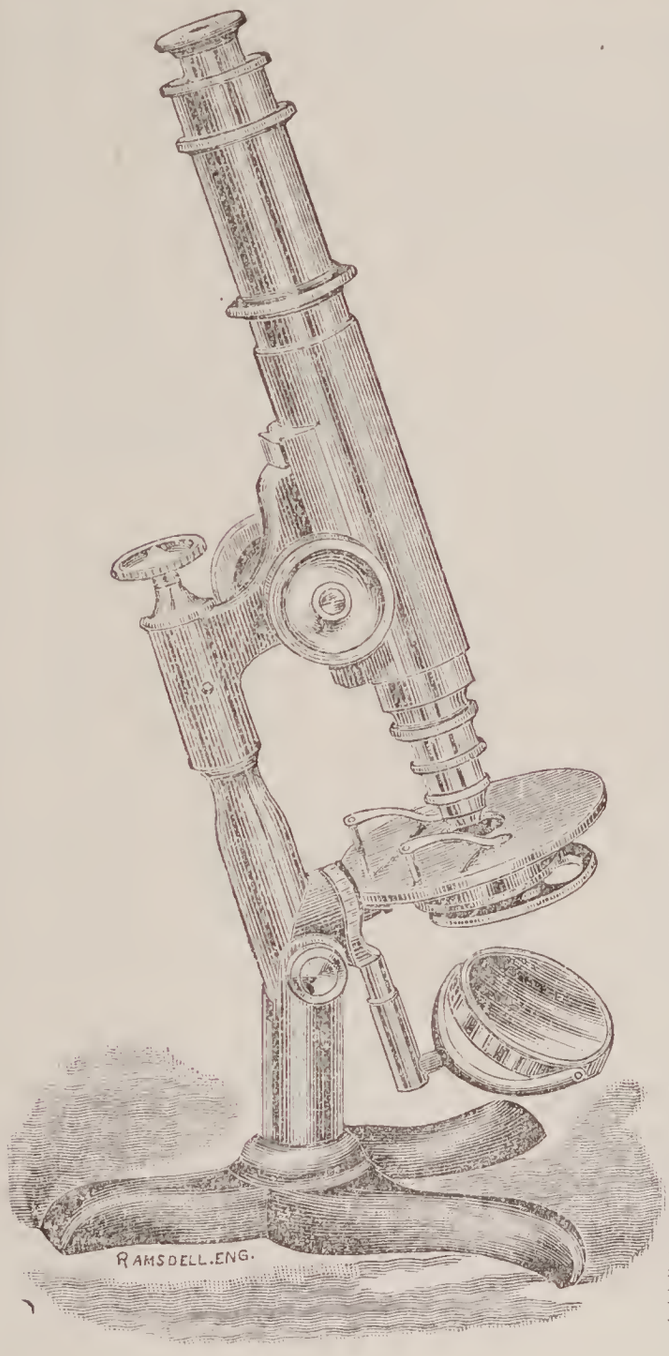

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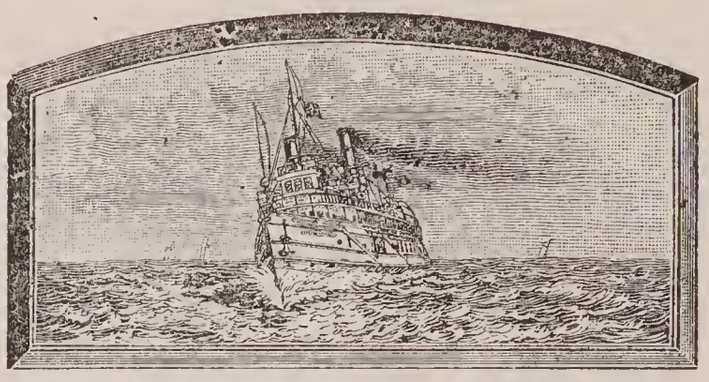

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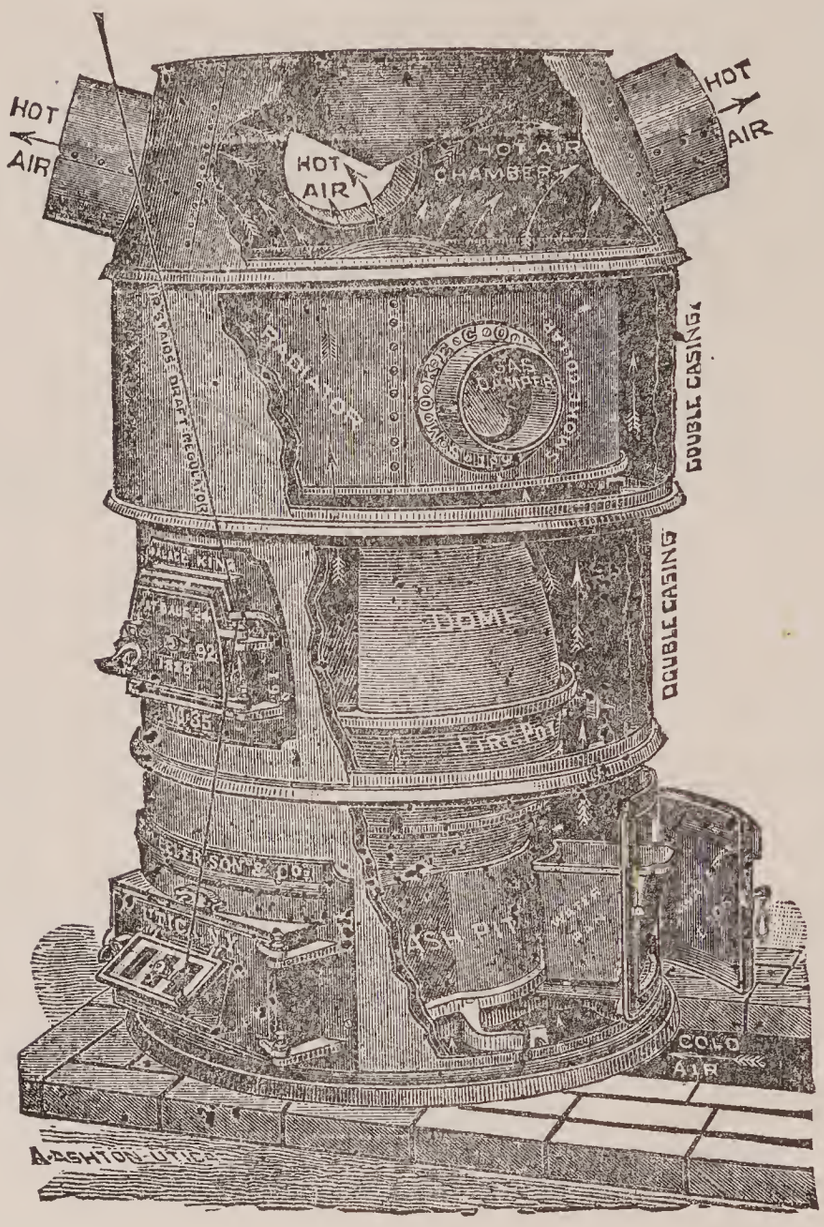

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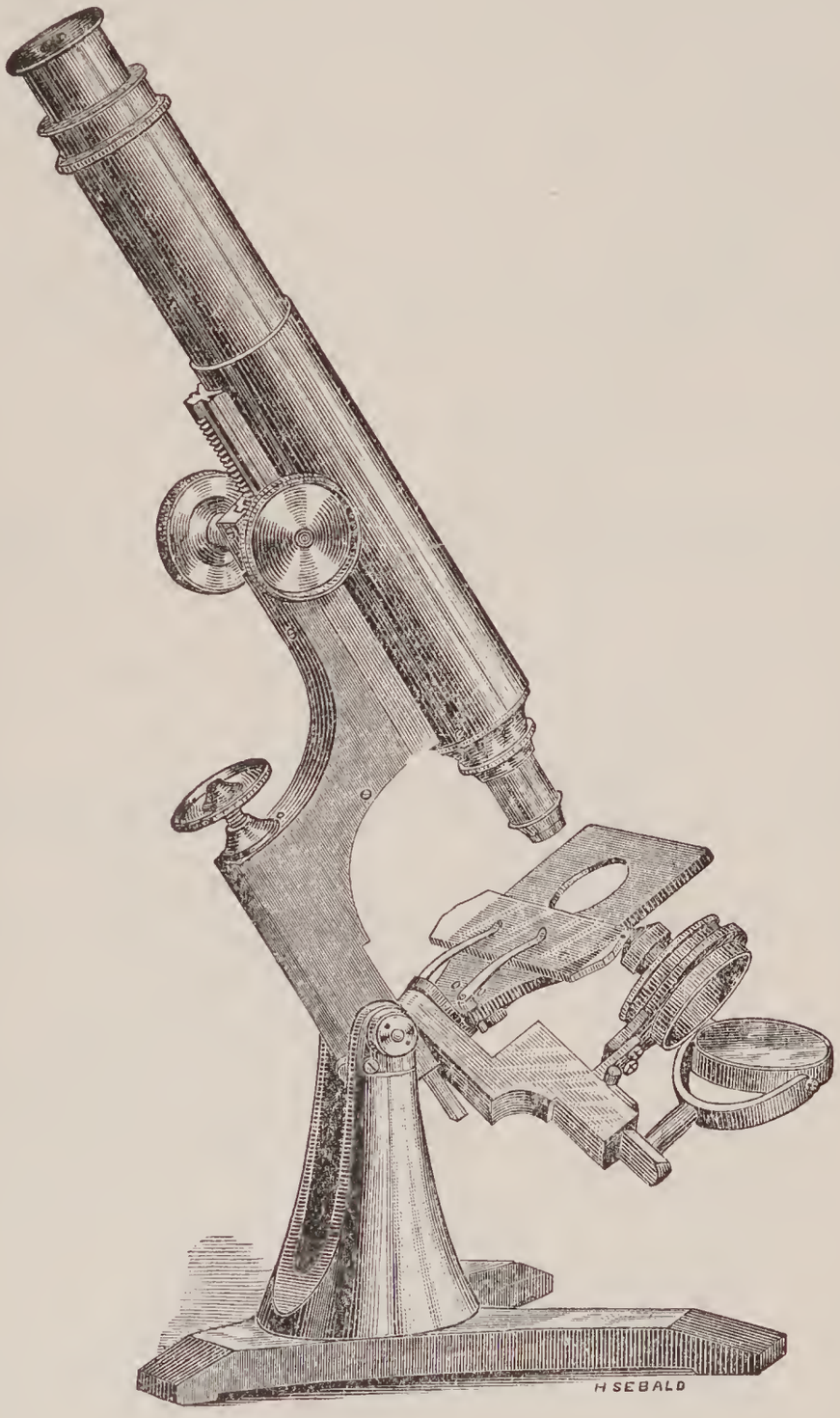

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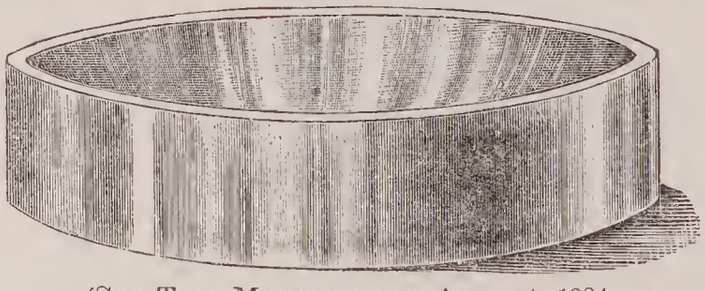

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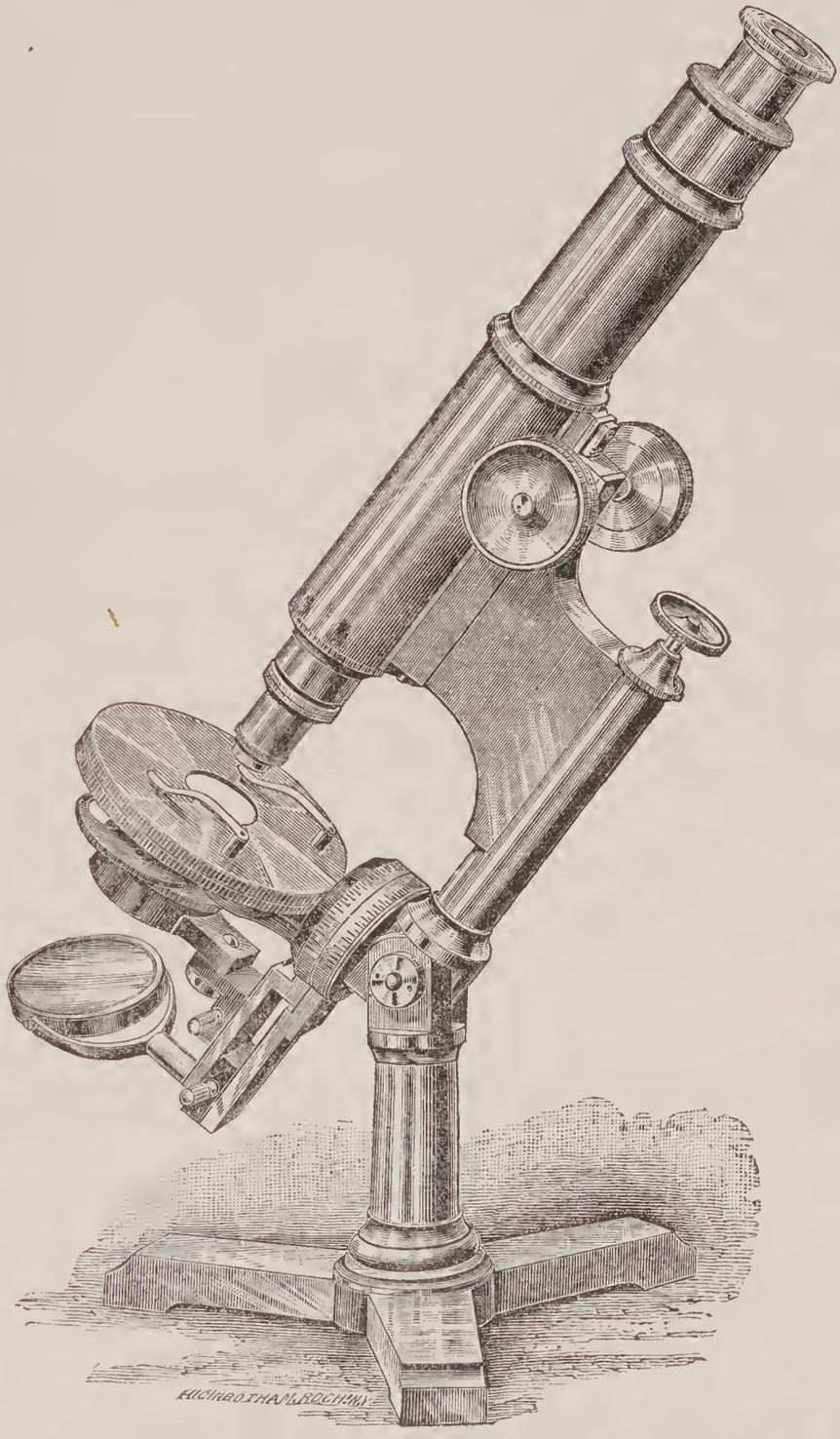

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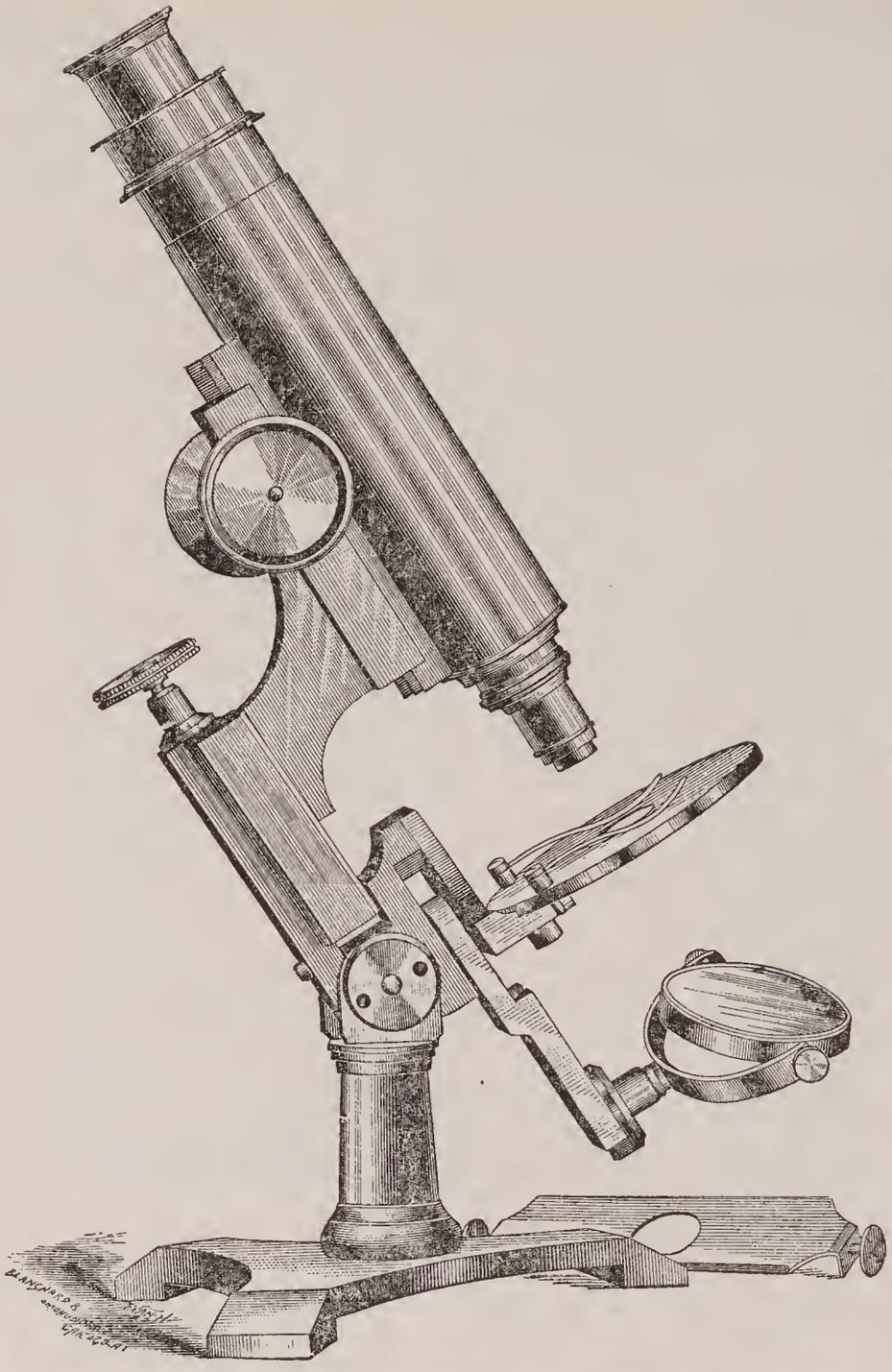

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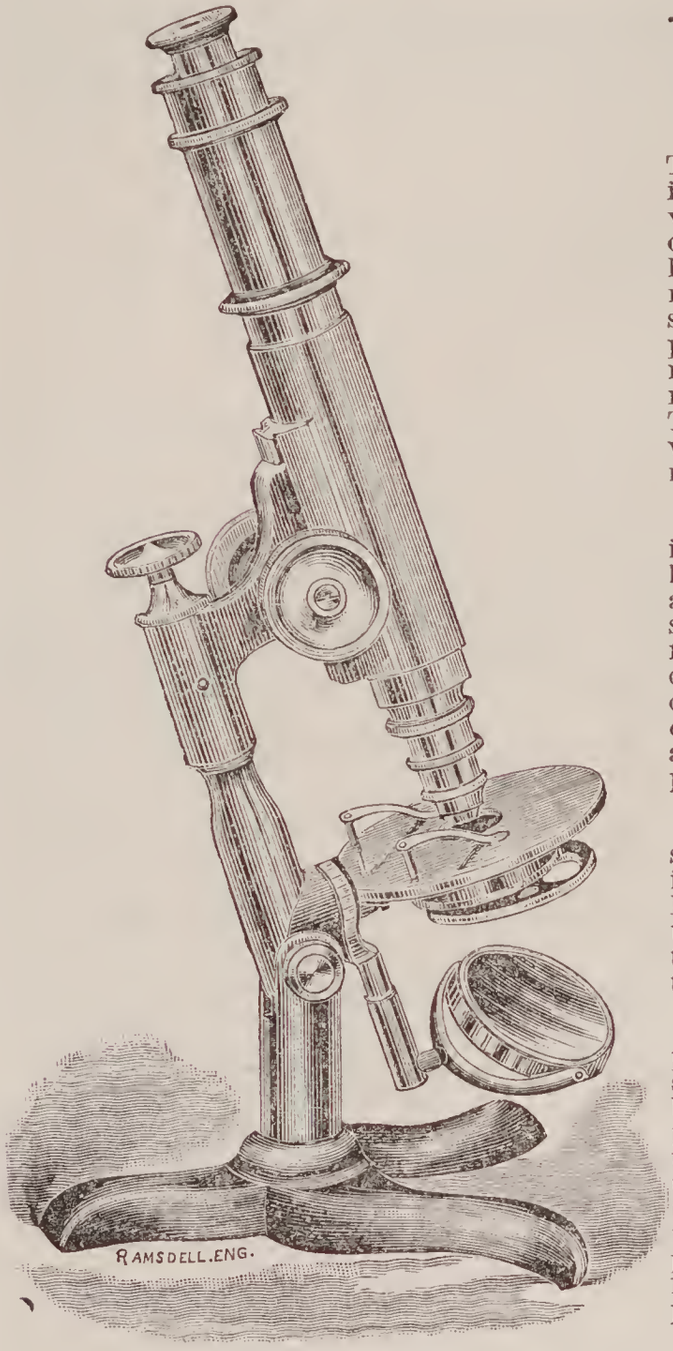

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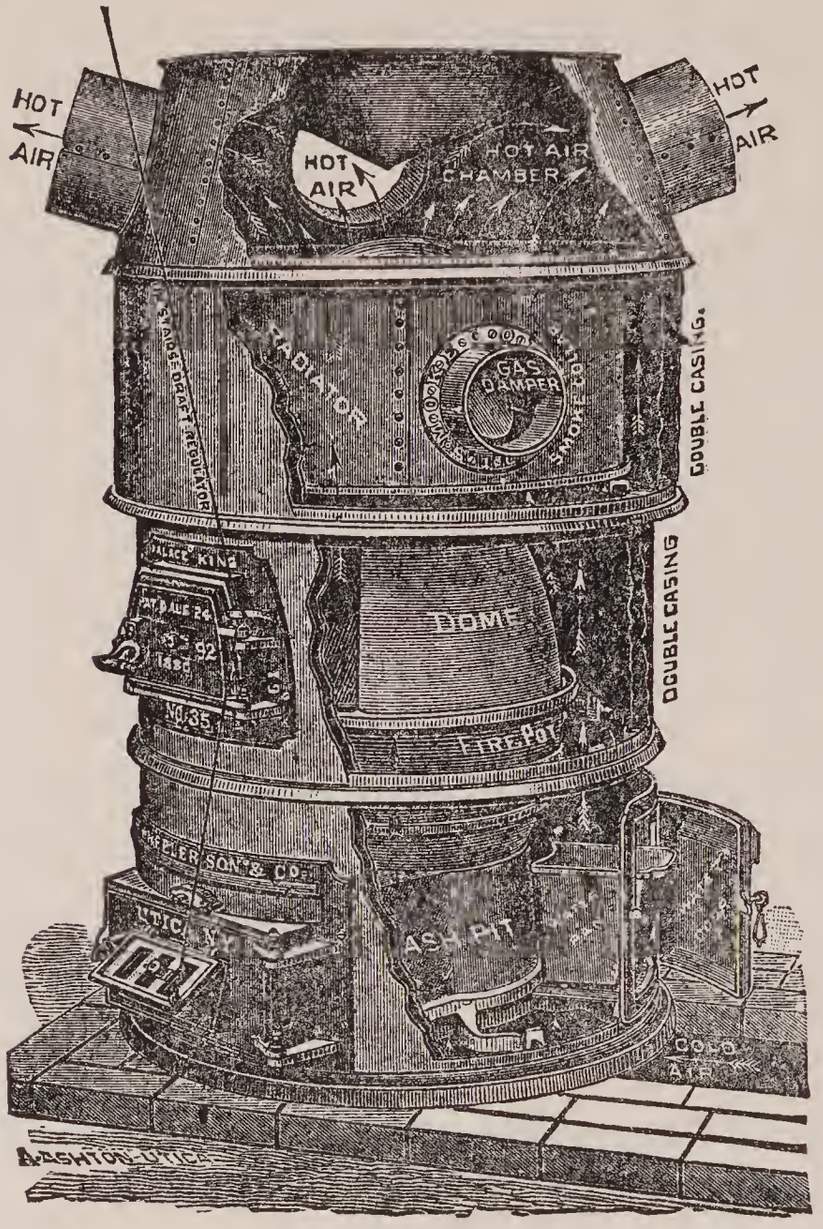

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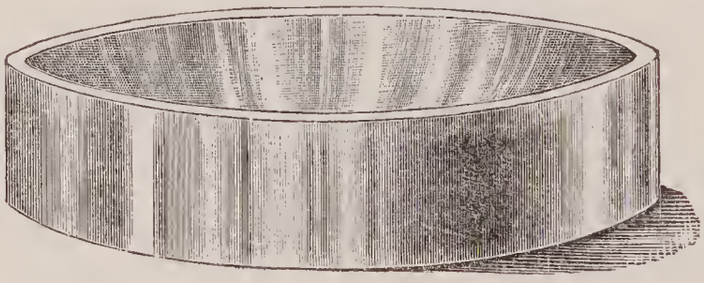

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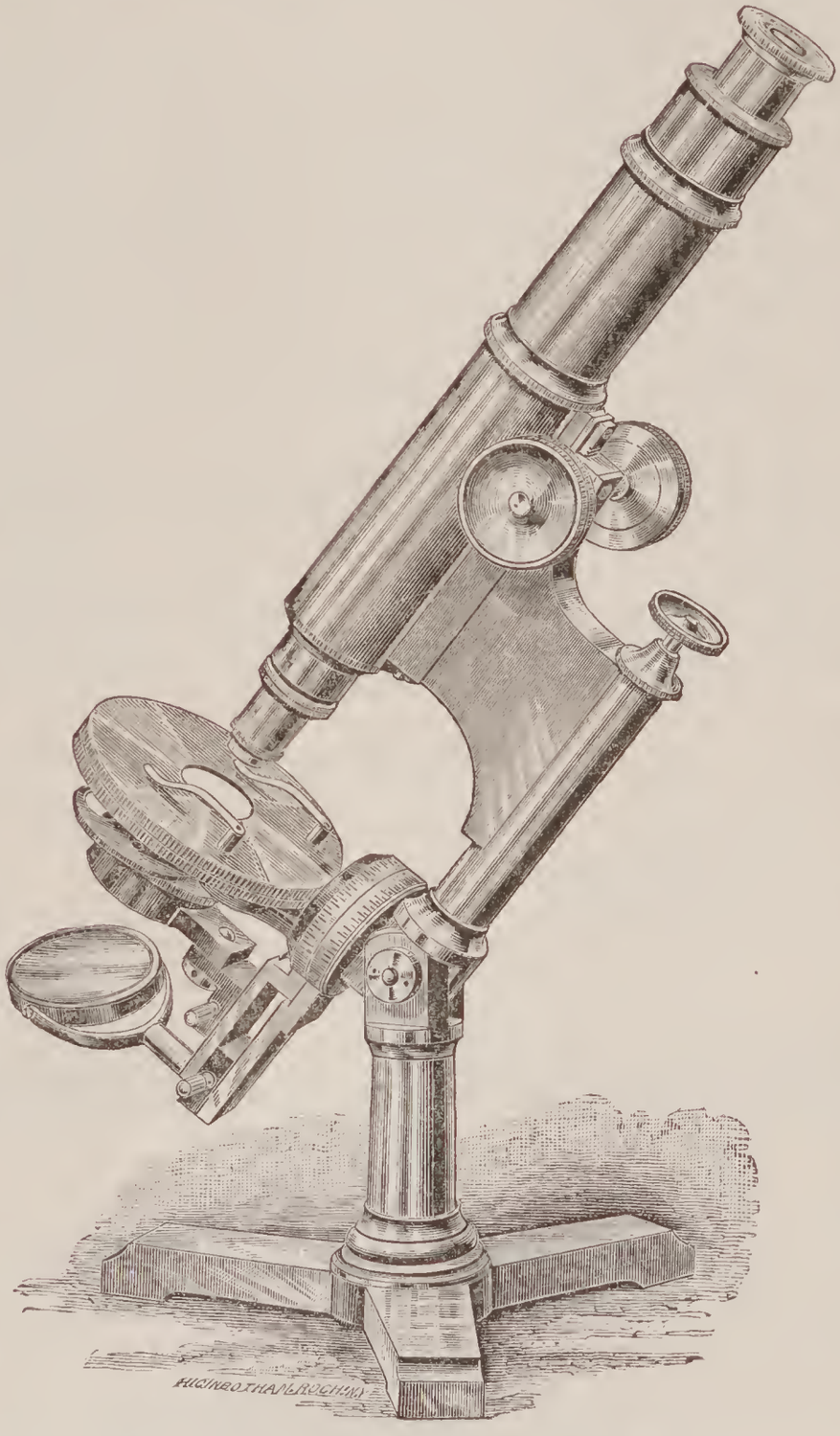

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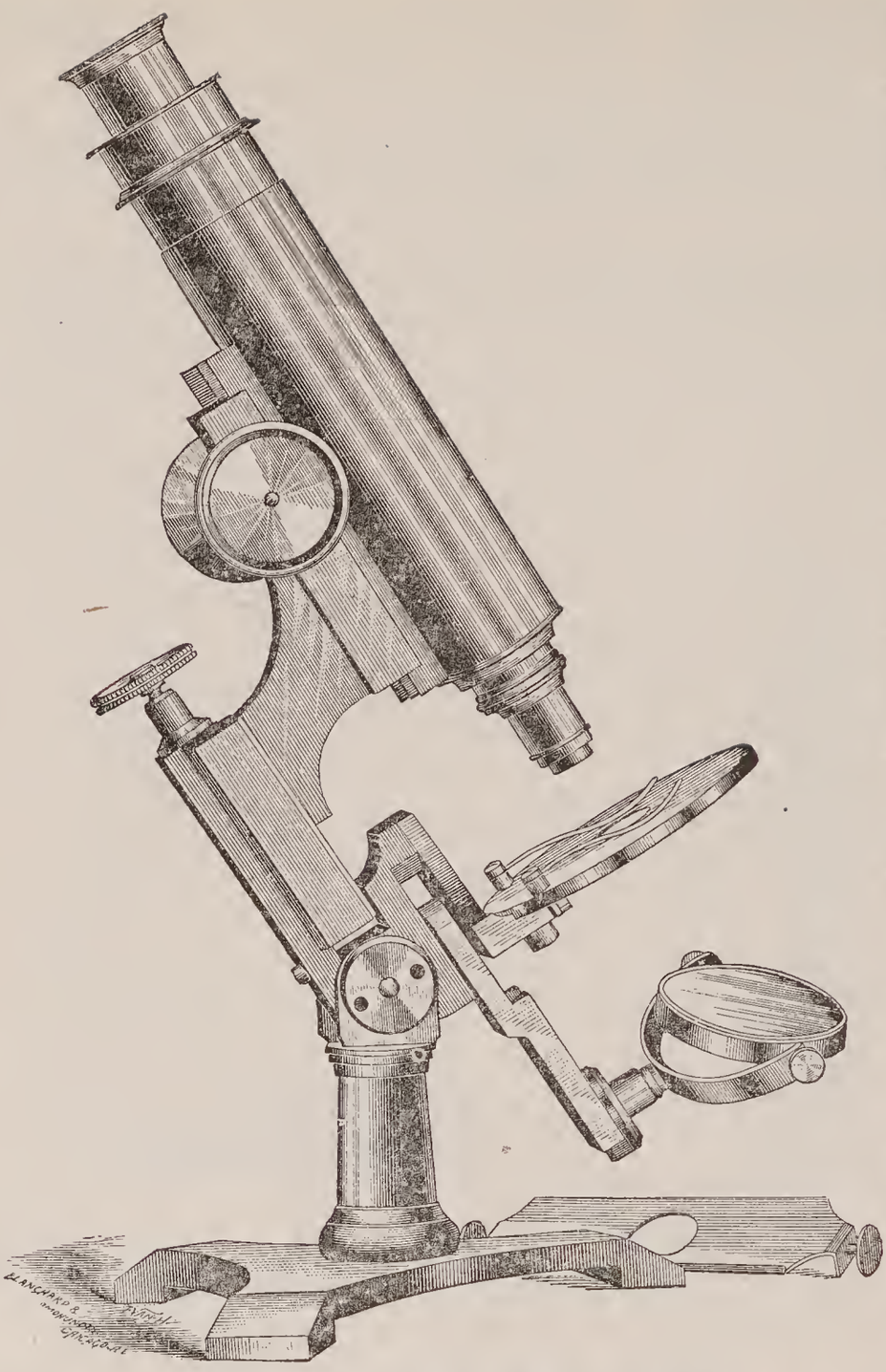

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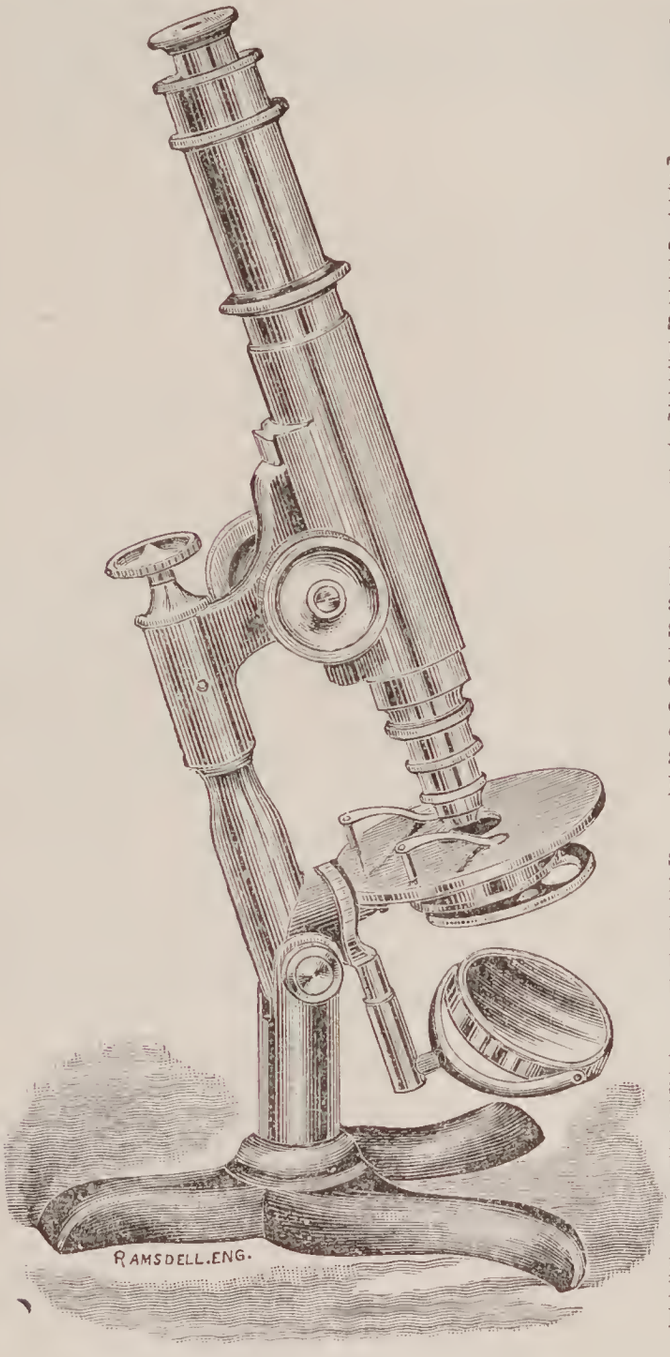

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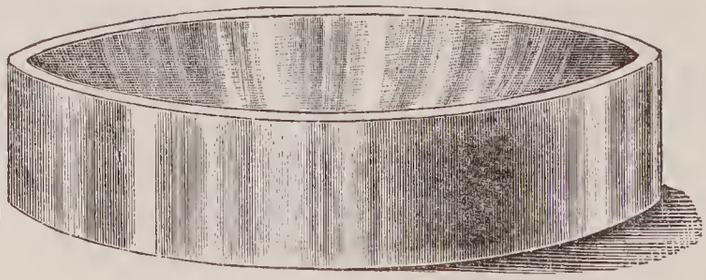

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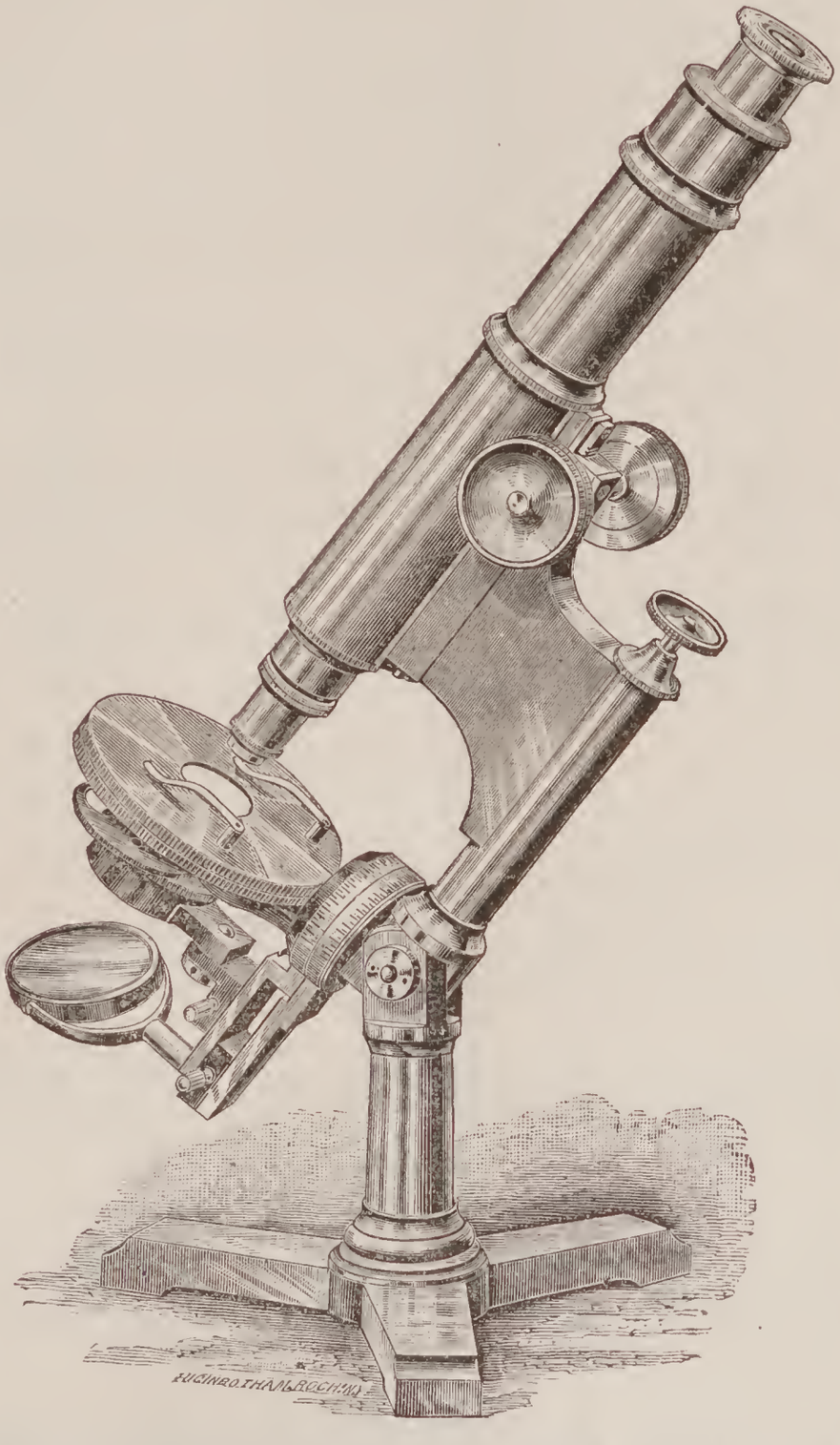

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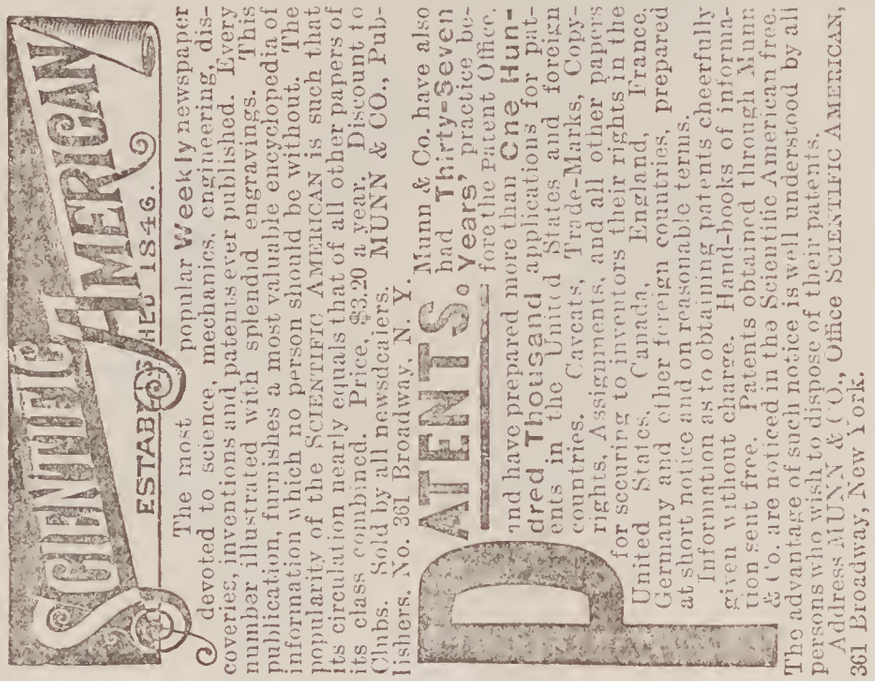
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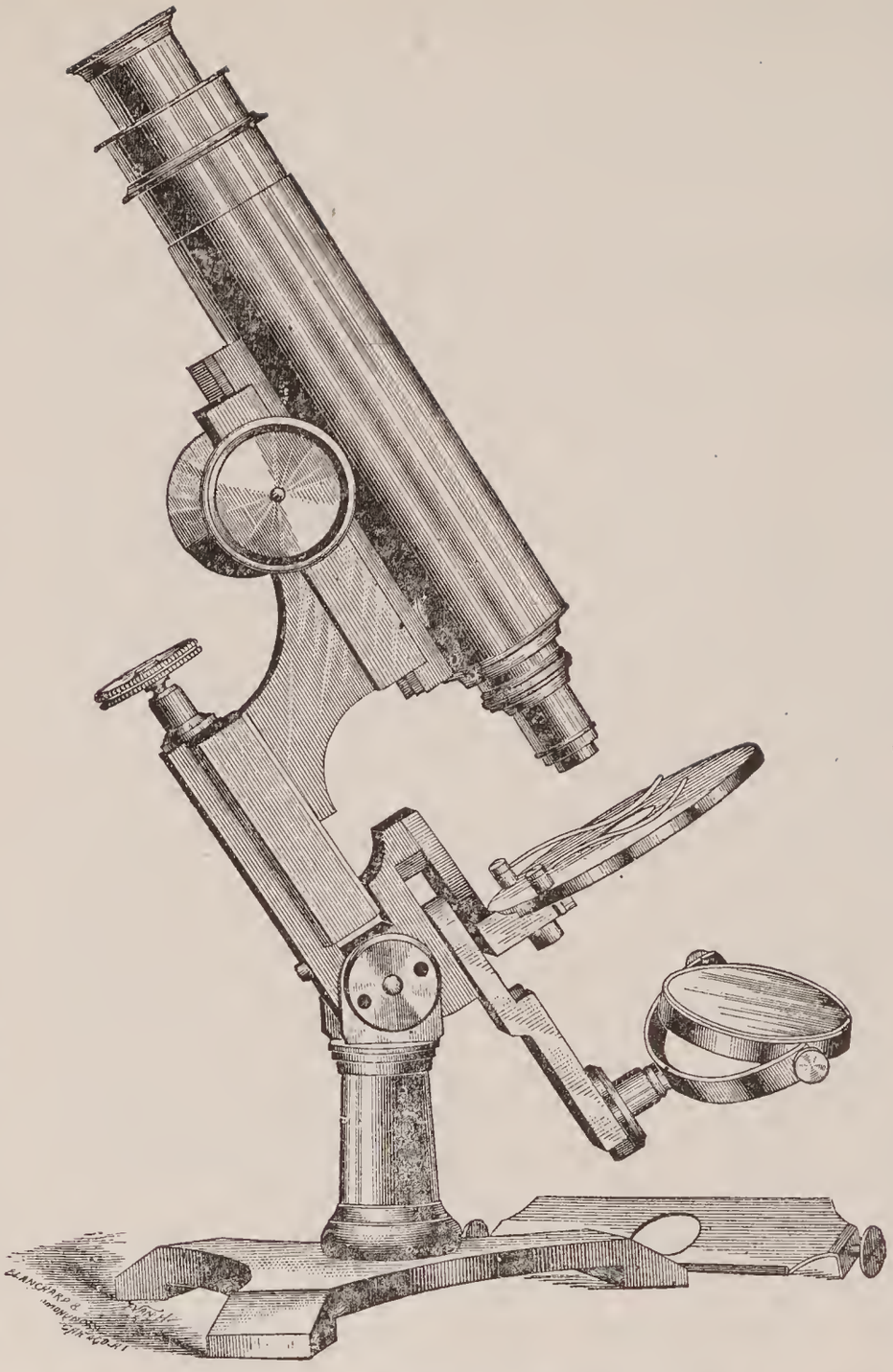

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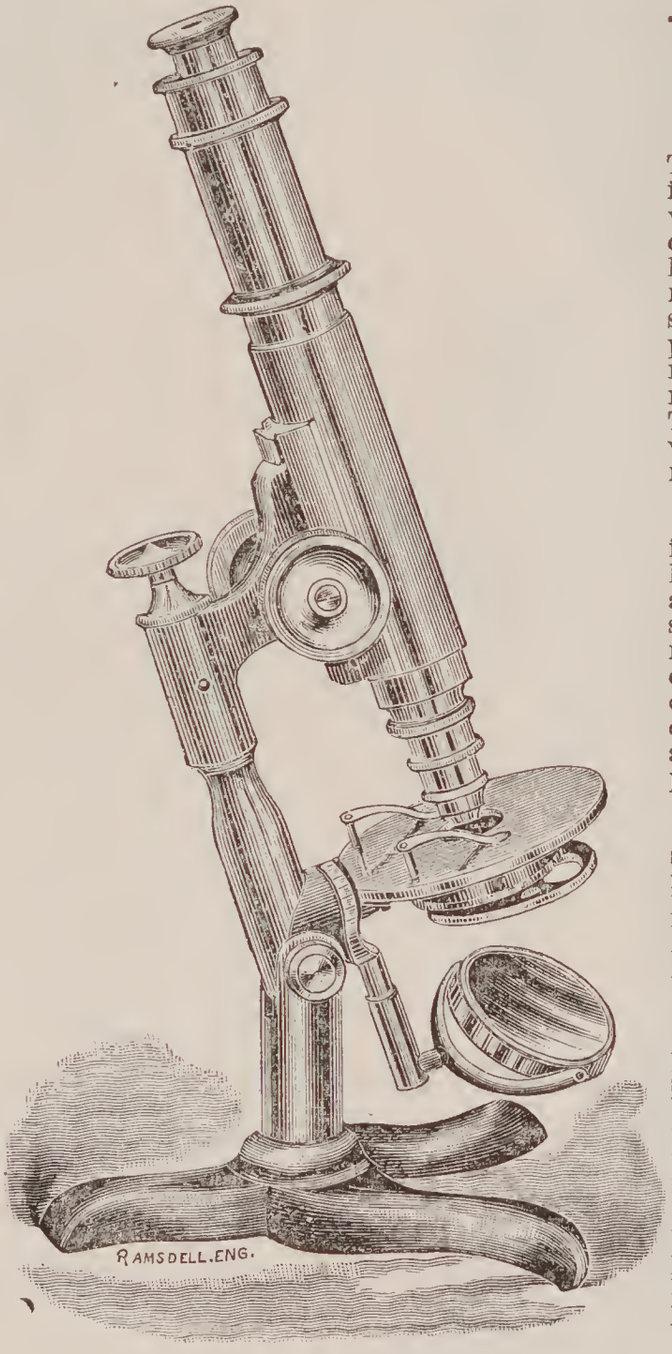

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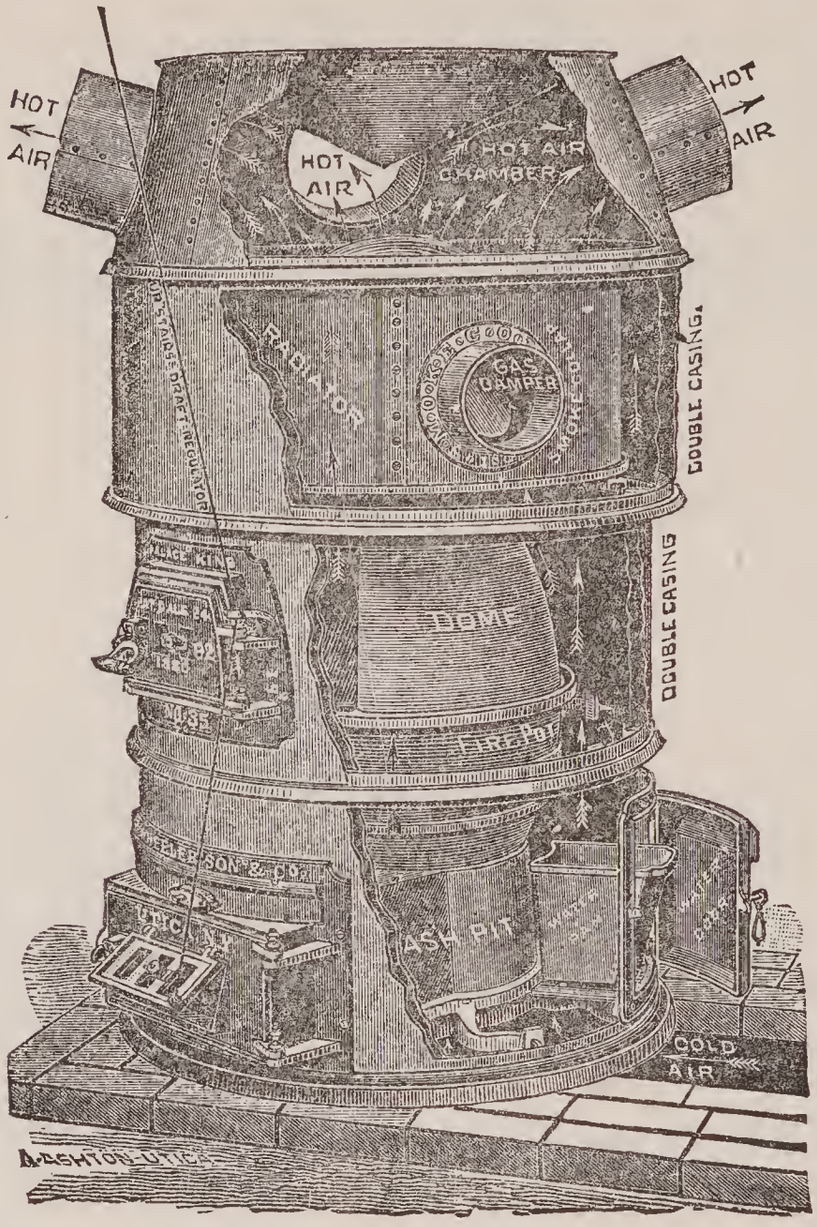

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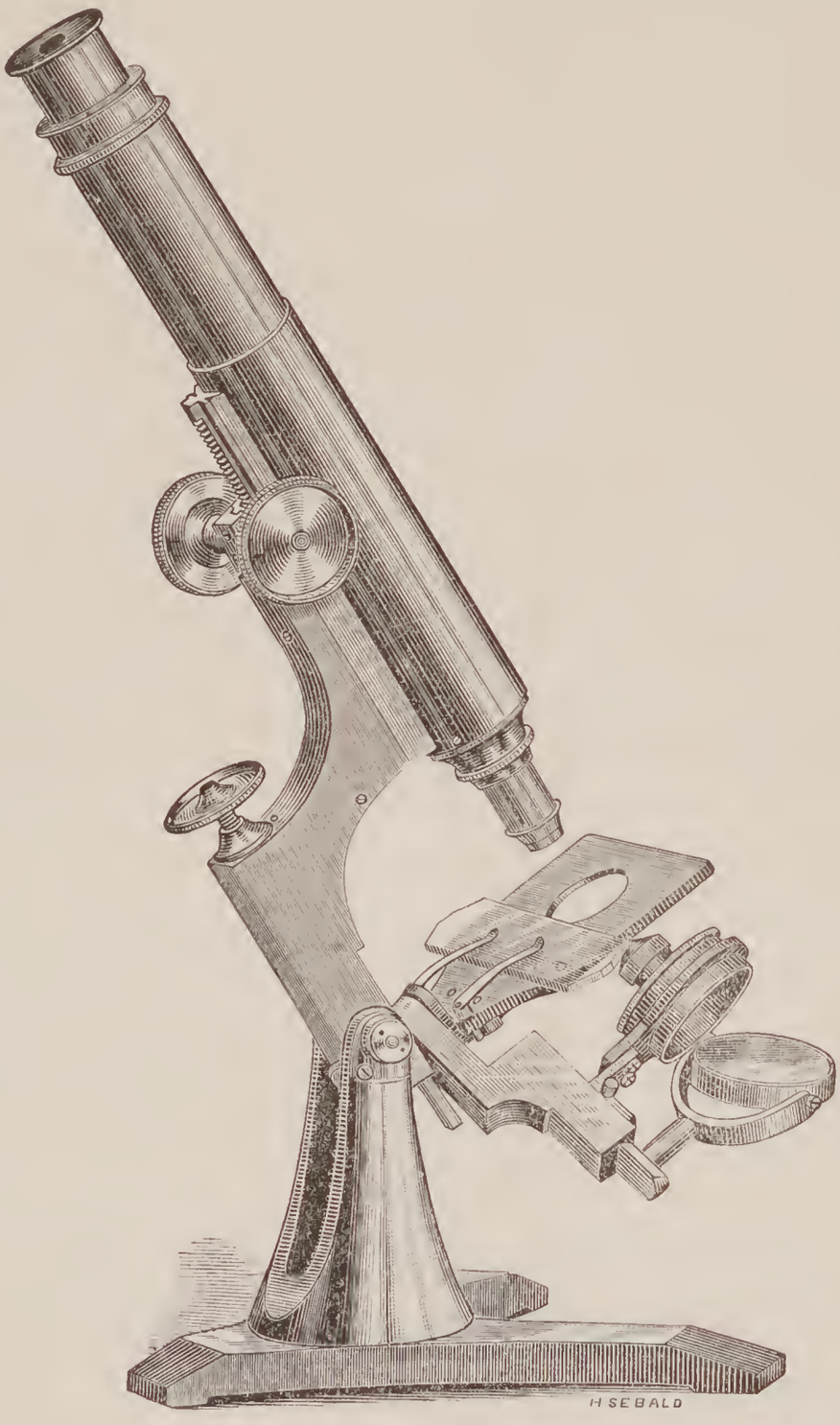

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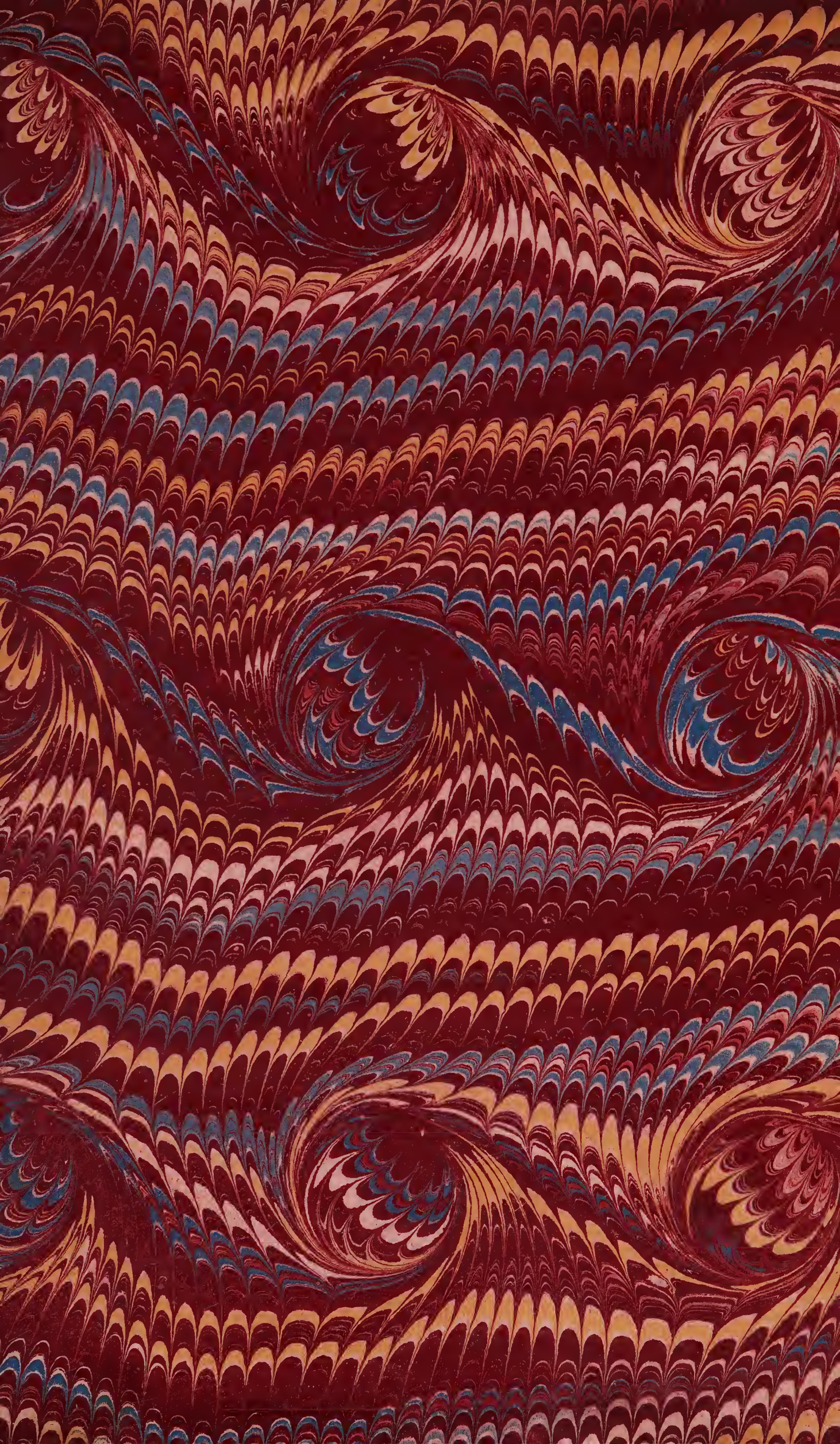
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